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# The Effect of Joint and Several Liability on the Bankruptcy Rate of Defendants: Evidence from Asbestos Ligation

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**Abstract**

The Effect of Joint and Several Liability on the Bankruptcy Rate of Defendants: Evidence from Asbestos Litigation - Under the doctrine of joint and several liability, if two defendants jointly share a liability and the first becomes insolvent, his unpaid liabilities may be reallocated to the second, solvent defendant. While the second defendant's assets may be sufficient to cover his own share of the liability, they may be insufficient to also cover the first defendant's unpaid liability. As a result the first defendant's insolvency may trigger the second defendant's insolvency (White 2002, Cupp 2003).

The purpose of this paper is to quantify the pressure that one defendant's bankruptcy places on the solvency of co-defendants in the context of mass torts subject to joint and several liability. The specific tort we examine is asbestos poisoning. We choose this example because of the large number of companies – over 61 since 1982 (Stiglitz et al. 2003) – that have gone bankrupt due to asbestos litigation and the even larger number of companies – perhaps as many as 8,000 (Brickman 2004) – that have been named as defendants in asbestos suits.

Using 10-K data from a number of large asbestos defendants and a data set of all judgments in asbestos trials, we estimate that the mean per-claim payments by major defendants grew an additional 5 to 10 percent annually or 56 to 157 percent altogether between 1990 and 2002 due to the bankruptcy of jointly liable defendants during this period. To put it another way, if no companies had gone bankrupt between 1990 and 2002, the asbestos liabilities of solvent defendants might have been less than two-fifths their present size.

This result is also a contribution to the literature on bankruptcy and on mass torts. First, numerous scholars have suggested tort claimants ought to be given superpriority in bankruptcy to reduce their exposure to the risk of a defendant's insolvency. We demonstrate that, with joint and several liabilities, this risk is actually reallocated to jointly liable but solvent defendants. Tort superpriority would reallocate some of this risk to other creditors, which seems neither fair nor efficient. Second, in the debate over how to compensate victims of mass tort – case-by-case litigation, class actions, valuation in bankruptcy, or legislative trust – one criticism of piecemeal litigation has been that it leaves the plaintiff bearing the risk of defendant insolvency. Our findings provide evidence otherwise in the case of joint and several liabilities

# The effect of joint and several liability on the bankruptcy rate of defendants: evidence from asbestos litigation

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Under the doctrine of joint and several liability, if two defendants jointly share a liability and the first becomes insolvent, his unpaid liabilities may be reallocated to the second, solvent defendant. While the second defendant's assets may be sufficient to cover his own share of the liability, they may be insufficient to also cover the first defendant's unpaid liability. As a result the first defendant's insolvency may trigger the second defendant's insolvency [26, 11].

The purpose of this paper is to quantify the pressure that one defendant's bankruptcy places on the solvency of co-defendants in the context of mass torts subject to joint and several liability. The specific tort we examine is asbestos poisoning. We choose this example because of the large number of companies — over 61 since 1982 [24, p. 52] — that have gone bankrupt due to asbestos litigation and the even larger number of companies — perhaps as many as 8,000 [6] — that have been named as defendants in asbestos suits.

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> to 10 percent annually or 56 to 157 percent altogether between 1990 and 2002 due to the bankruptcy of jointly liable defendants during this period. To put it another way, we conclude that, if no companies had gone bankrupt between 1990 and 2002, the asbestos liabilities of solvent, major asbestos defendants might have been less than two-fifths their present size.

Under the doctrine of joint and several liability, if two defendants jointly share a liability and the first becomes insolvent, his unpaid liabilities may be reallocated to the second, solvent defendant. While the second defendant's assets may be sufficient to cover his own share of the liability, they may be insufficient to also cover the first defendant's unpaid liability. As a result the first defendant's insolvency may trigger the second defendant's insolvency [26, 11]. The plaintiff may be better off: with joint and several liability she is able to recover from the second defendant all his assets, not just his proportionate share of liability to the plaintiff. But the second defendant's insolvency may cause dislocation to the defendant's unsecured creditors and workers.[1]

The purpose of this paper is to quantify the incentive that joint and several liability provides for a defendant to go bankrupt once jointly liable defendants go bankrupt. The magnitude of the incentive will depend on the size of liabilities of previously solvent defendants relative to assets of presently solvent companies, and the latter will vary by context. We seek to illustrate how powerful this incentive can become by examining the amount of liabilities transferred from insolvent to solvent defendants in the context of modern mass tort litigation. The specific tort we examine is asbestos poisoning. We choose this example because of the large number of companies — over 61 since 1982 [24, p. 52] — that have gone bankrupt due to asbestos litigation and the even larger number of companies — perhaps as many as 8,000 [6] — that have been named as defendants in asbestos suits.

Figure 1 illustrates the reason for concern. It plots the number of companies that declared bankruptcy due to asbestos liabilities between 1982 and

[1] Stiglitz et al. [24, p. 52] estimate that asbestos bankruptcies have been responsible for the loss of 52,000 - 60,000 jobs; that each of these workers lost on average $25,000 - $50,000 in wages as a result of these bankruptcies; and that each of these workers who were at firms with a 401(k) plan lost on average $8,300 in pension benefits. Austern [4, p. 8] notes that, in 1988 dollars, the bankruptcy of Johns-Manville Co., which had a market cap of $1.8 billion when it went bankrupt due to asbestos liabilities, cost $100 million in transactions costs.

2002. It also depicts an estimate of the average payments made by individual defendant companies to individual plaintiffs who filed asbestos-related tort claims between 1990 and 2002.[2] The reader will notice in particular the coincidence of sharp upswings in the number of bankruptcies and the average payment per claim between 1998 and 2002. During the latter period per-claim payments grew on average $155 — over 6 percent — for every company that went bankrupt.

The analysis in this paper proceeds in two steps. First, we identify the growth rate of payments by individual defendants to individual plaintiffs on claims of illness due to asbestos exposure.[3] This is estimated from 10-K filings of certain large asbestos defendants, which cumulatively account for 30-50 percent of the universe of asbestos defendants by dollar of liabilities. These data span the period 1990 - 2002 and cover over 3.9 million plaintiffs and payments of nearly $15 billion.

The growth rate of payments has two components. One is natural growth that would exist even if defendants were not joint and severally liable for asbestos poisoning. This natural growth may be due to discovery of new evidence, changes in liability or damages rules, changes in litigation strategy, or growth in the wages or savings of injured workers. The other component of the overall growth rate of payments is growth due to joint and several liability. Dividing the overall growth rate by the natural growth rate will identify the growth rate due to joint and several liability.

Therefore, the second step of our analysis is to estimate the natural growth rate of payments on claims. We estimate this growth rate of asbestos claim payments by exploiting the fact that joint and several liability may raise the recovery from *a particular defendant* but should not raise the recovery by the *plaintiff*. When a defendant who jointly shares a liability with a second defendant becomes insolvent, the liability faced by the second defendant rises by the amount of the first defendant's liability that remains unpaid. However, the sum of both defendants' tort claim payments for

[2] We report a simple average of growth in per-claim payments across seven large asbestos defendants that were solvent during the entire period of our study, 1990-2002, and for whom we have 10-K data on asbestos payments.

[3] In this version of the paper we do not break down claim value growth by disease of the tort claimant. The distribution of claims by disease is relatively constant over our study period, even taking into account the disease mix of claims against companies that go bankrupt during our study period. In future drafts we will attempt to provide disease-specific growth rates.

that liability does not grow. This is true for any given moment in time. Therefore, if one examines the sum of tort payments across all defendants per plaintiff for different years, the growth rate that emerges is growth which is independent of joint and several liability. We estimate the natural growth rate using the same 10-K data as above plus a data set that includes the universe of awards in asbestos cases resolved through court judgment. Because those judgments reflect the joint and several liability of the named defendant for all possible defendants, they also reflect the natural growth rate of tort payments.

We find that the mean payment by a major asbestos defendant to resolve an asbestos suit by a single plaintiff grew 17 percent during each of two waves of asbestos-related bankruptcies — the first from 1990-1993 and the second from 1999-2002. Yet the sum of payments per plaintiff grew between 3 and 8.5 percent per year during the 1990-2002 period. Therefore, we estimate the growth in per-claim payments attributable to these bankruptcy waves to be at least 5 to10 percent annually or 56 to 157 percent over the entire 1990-2002 period. To put it another way, we conclude that, if no companies had gone bankrupt between 1990 and 2002, the asbestos liabilities of solvent, major asbestos defendants might have been as small as two-fifths their present size.

This result is a contribution not just to the literature on joint and several liability in tort law, but also to the literature on the resolution of tort claims in bankruptcy and on the optimal mechanism — simple tort, class actions, bankruptcy or legislative compensation — for resolving mass tort claims. First, a number of scholars have suggested that tort claimants may not be adequately compensated when defendants enter bankruptcy. Joint and several liability theoretically solves this problem by reallocating an insolvent defendant's liability to jointly liable but solvent defendants. This paper demonstrates that this redistribution actually occurs in practice and that, therefore, it may not be necessary — as some scholars suggest — to increase the priority of all tort claimants in bankruptcy. Second, a number of scholars have argued that a class action, valuation of tort claims in bankruptcy, or legislation of a workers' compensation-type regime would be a superior method to compensate victims of mass tort than resolution of individual claims in tort. One of the criticisms levied against the latter is that it leaves the plaintiff bearing the risk of defendant insolvency. Our findings suggest otherwise.

This paper may be outlined as follows. Section 1 describes the doctrine of joint and several liability and its interaction with bankruptcy law. Section

2 describes the methodology employed to estimate the growth rate of tort recoveries due to joint and several liability. Section 3 presents our data, some further technical details regarding our estimation strategy, and the results of our analysis. It also draws out the implications of these results for joint and several liability. Section 4 concludes with a discussion of the relevance of our findings to bankruptcy law and mass tort compensation.

# 1 Legal background

Suppose that two defendants, $D_1$ and $D_2$, engage in "independent tortious conduct that is a legal cause of an indivisible injury" to plaintiff $P$ valued at $L$. Moreover, according to principles of comparative fault, $D_1$ is responsible for portion $L_1$ and $D_2$ for portion $L_2$ of the plaintiff's total loss.[4] The Restatement (3d) of Torts §17 says that the defendants may be severally liable or jointly and severally liable for that loss, depending on the law of the applicable jurisdiction. If liability is several, to recover $L_1$ the plaintiff must sue $D_1$. To recover $L_2$ she must sue $D_2$. In contrast, if liability is joint and several, $P$ may sue either $D_1$ or $D_2$ for the entire injury $L$.

Table 1 indicates whether defendants are currently liable severally or joint and severally for asbestos poisoning in each of the 50 states and D.C. Among jurisdictions with joint and several liability, one can find four distinct flavors of this doctrine. One imposes joint and several liability so long as the plaintiff has no comparative responsibility for her injury. Otherwise the defendants are merely severally liable. A second imposes joint and several liability only on defendants with comparative responsibility greater than some threshold, typically 50 percent. A third imposes joint and several liability only for a certain type — economic or noneconomic — of damages or for damages below some ceiling. The final rule imposes joint and several liability without any conditions whatsoever. This last variant of the doctrine is called a pure joint and several rule. At opposite ends of the spectrum, one finds 14 states with several liability and 18 states with pure joint and several liability.

[4] The sum of these portions and the portion $L_P$ for which the plaintiff is herself responsible equals the total injury to the plaintiff: $L_1 + L_2 + L_P = L$.

## 1.1 Solvent defendants' perspective

Suppose liability is joint and several and $P$ sues $D_1$ for the entire loss and does not sue $D_2$ at all. It is then the responsibility of $D_1$ to seek compensation from $D_2$. $D_1$ can do this in two ways. First, when $P$ sues $D_1$, $D_1$ can compel $D_2$ to join the suit. Whether joinder is permitted depends on state procedural rules.[5] If joinder is permitted, $P$ may recover $L_1$ from $D_1$ and $L_2$ from $D_2$ all in one legal action. Second, if $D_1$ fails to join $D_2$ and $P$ obtains a judgment for $L$ against $D_1$, $D_1$ can — again, state law permitting — file a separate suit for contribution from $D_2$.[6] The size of the contribution depends on whether state law permits $D_1$ to recover from $D_2$ a pro rata portion $(L/2)$ of the total loss or the portion $(L_2)$ dictated by comparative fault.[7]

Suppose again that liability is joint and several, but $P$ sues both $D_1$ and $D_2$; that $D_1$ settles for $S_1$; and that $D_2$ litigates. Despite joint and several liability, the litigating defendant may not be responsible for the entire liability. Most states have set-off rules that deduct from the total joint and several liability of the litigating defendant either the amount of other defendants' settlements (pro tanto set-off) or the amount of other defendants liabilities (proportional or comparative fault set-off). Thus, under a pro tanto rule, the maximum exposure for $D_2$ is $L - S_1$. Under a proportional rule, the maximum judgment is $L - L_1$. Note that a joint and several liability regime with a proportional set-off rule is very similar to several liability regime.[8]

Suppose that $D_1$ settles for $S_1$ and $D_2$ loses a judgment equal to $J_2$. If a defendant's settlement or judgment amount is less than his equitable share of the total tort liability, then that defendant cannot seek contribution from

[5] Restatement (3d) Torts [25, §17 cmt. a] provides a survey of state joinder rules. In federal court joinder is accomplished through an impleader action under Fed. R. Civ. Pro. 14(a), subject to limits under Rules 19 and 20.

[6] Failure to join the defendant from whom contribution is sought in the original action by the plaintiff is not generally a defense to a contribution action. However, there is a risk that the contribution action will yield an inconsistent verdict on the same set of evidence [13, p. 951].

[7] Restatement (3d) Torts [25, §23 cmt. a] provides a survey of state contribution laws. The common law rule from *Merryweather v. Nixan* [1] prohibits contribution. Few states follow this rule.

[8] There is also the theoretical possibility of a pro rata set-off rule, under which $D_2$'s maximum exposure is $L/2$ [25, §16 cmt. c]. No state has such a set-off rule. Kornhauser and Revesz [14, pp. 438-440] and Hynes and Bonner [13, pp. 974-978] provide a survey of set-off rules.

other defendants. In other words, if $S_1 < L_1$, then $D_1$ has no right to contribution from $D_2$. If $J_2 < L_2$, then $D_2$ cannot seek contribution from $D_1$. Conversely, if a defendant's settlement or judgment is greater than his equitable share of the total tort liability, then that defendant is immune from contribution claims by other defendants [14, pp. 440-442].

Suppose that $D_1$'s settlement or paid judgment exceeds his equitable share of liability and $D_2$'s settlement or paid judgment is less than his equitable share of the total tort liability. Can $D_1$ seek contribution from $D_2$? If $D_2$ settles, then $D_1$ cannot seek contribution, though most jurisdictions require that the settlement by $D_2$ have been in good faith [25, §23 cmt. i].[9] If $D_2$ does not settle, then $D_1$ may be able to seek contribution from $D_2$. However, many jurisdictions require the defendant who seeks contribution to have fully extinguished the liability of the defendant from whom he seeks contribution. Moreover, if $D_1$ settles, he can only seek contribution from $D_2$ if the plaintiff, as part of her settlement with the $D_1$, releases the $D_2$ from liability [25, §23 cmts. b, h]. These contribution rules are summarized in Table 2.

## 1.2 Insolvent defendants

Of greater relevance to this paper is what happens if one of the defendants, say $D_1$, has insufficient assets $A_1$ to cover his portion $L_1$ of the liability to $P$. $D_1$ may declare bankruptcy. If $P$ has already obtained a judgment against $D_1$, then she must file a claim against $D_1$'s estate. She has the same priority as unsecured creditors. If $P$ has been injured by $D_1$ and has filed suit but not obtained a judgment against $D_1$, the bankruptcy court must estimate the size of $D_1$'s liability to $P$ and permit a claim of that value against the bankruptcy estate with the same priority as a claim by an unsecured creditor.

If there is a class of plaintiffs with pending suits or there is a class of people that has been injured by $D_1$ and has not filed suit, but is very likely to do so in the future, then the bankruptcy court is to estimate the size of $D_1$'s liabilities to such present and future plaintiffs, create — under §524(g) of the U.S. Bankruptcy Act of 1978 — a trust to cover these liabilities, and finance this trust with certain of $D_1$'s assets. The assets the court can allocate

[9] Courts are divided on whether the good faith inquiry is a procedural inquiry or a substantive one that requires a comparison of $S_1$ with a quick estimate of $L_1$ [14, p. 441].

to the trust are those left over after first paying secured creditors the full value of their secured claims and then giving unsecured ordinary creditors a portion of the remaining assets equal to their share of the total claims by unsecured ordinary creditors and tort claimants against $D_1$. That said, there are certain assets that are most valuable in the hands of the trust and therefore find their way there. These include insurance policies to cover $D_1$'s tort liabilities and contribution claims that $D_1$ may have against jointly liable defendants. Other generic assets — cash or equipment — also find their way into the trust. Because tort claimants have less priority than secured credit, the trust is also likely to contain $D_1$'s equity. Hence the plaintiffs are likely to own the firm after bankruptcy, though they are permitted to sell their shares at any time.

What happens to the unpaid portion of $D_1$'s liability, $L_1 - A_1$? In a jurisdiction with several liability, the loss is borne by the plaintiff. $D_2$ can only be held responsible for $L_2$. In joint and several jurisdictions, however, some of the loss may be reassigned to $D_2$. The fraction of $L_1 - A_1$ for which $D_2$ can be held liable depends on whether the state in which $P$ brings her suit has a pure joint and several rule or a reallocation statute. If the state has a pure joint and several rule, $D_2$ can be held liable for all of $L_1 - A_1$ [25, §10 cmt. b]. If the state has a reallocation rule that permits an insolvent defendant's liability to be assigned solely to solvent defendants, $D_2$ can again be held liable for all of $L_1 - A_1$. If the reallocation statute permits an insolvent defendant's liability to be assigned to both solvent defendants and the plaintiff, $D_2$ can only be held liable for a fraction of $D_1$'s unpaid liability. This fraction is $L_2/(L_2 + L_P)$, which is equal to his comparative fault relative to that of the plaintiff. The plaintiff bears the remaining share of $D_1$'s unpaid liability [25, §17].

Table 1 lists which states permit an insolvent defendant's liabilities to be reallocated at all or completely to solvent defendants. 24 states and D.C. permit reallocation of asbestos liabilities to solvent defendants. It should be noted that this number has fallen in recent years because a number of states have only recently — in the 1986-1987 or in the late 1990s — reformed their tort law to eliminate pure joint and several liability.

As a technical matter, neither the pure joint and several rule nor reallocation statutes specify whether $L_1$ or $L_1 - A_1$ is to be reassigned to $D_2$ and, perhaps, $P$. In practice, however, it appears that $L_1$ is reassigned and $D_2$ and $P$ are permitted to seek contribution out of $A_1$ from $D_1$'s estate. This assessment is based on cases, such as *Hosley v. Armstrong Cork Co.* (Minn.

19986) [17], which interpret reallocation statutes, and on trust distribution plans for defendants who file for bankruptcy due to asbestos liabilities. Reallocation statutes are silent with regard to the amount to be reallocated and the few courts that have addressed the issue reassign $L_1$ rather than $L_1 - A_1$. Moreover, trust distribution plans appear to contain provisions whereby defendants jointly liable with a bankrupt defendant may seek contribution from the latter's estate [18, 3, §5.6]. That said, we have spoken to trustees of tort victim trusts of such bankrupt entities as UNR and found that few if any contribution claims have been made, let alone paid out, by these trusts.

Suppose $D_1$ goes bankrupt because it has fewer assets than its share of liabilities, $D_1$'s liabilities are reallocated to $D_2$, but $D_2$ does not have enough assets to cover its own liability plus $D_1$'s, i.e., $L_2 < A_2 < L_1 + L_2$. $D_2$ may also declare bankruptcy. A natural question is: can $D_2$'s estate, having perhaps established a trust with assets to cover not just $L_2$ but also some of $L_1$, seek contribution against the estate of $D_1$? As far as we know, this question has not been answered by any court.[10] Whatever the answer turns out to be, however, $D_2$ will still have been forced into bankruptcy and will not be able to obtain more than $A_1 < L_1$ in contribution. This and other rules concerning reallocation and contribution with insolvent defendants are reproduced in Table 2.

To summarize, if one defendant has insufficient assets to cover his share of a joint and several liability to a plaintiff, that defendant's liabilities may be reallocated to a jointly liable but solvent defendant. If the second defendant ends up paying more than his equitable share of the liability, he can seek contribution from the bankruptcy estate of the first defendant, though in practice such actions are rare. If, however, the second defendant does not have sufficient assets to cover both his own share of the joint liability and the reassigned portion of the first defendant's share of that liability, the second defendant may also end up bankrupt.

[10] However, we see no reason why, if $D_2$'s trust has assets greater than $D_2$'s equitable share of liability plus the unpaid portion of $D_1$'s liabilities, $D_2$ should not be able to seek contribution from $D_1$'s estate.

# 2 Methodology

## 2.1 Simplified empirical model

The methodology in this paper can be illustrated by means of a simple two period model. Suppose there are three defendants $(D_1, D_2, D_3)$ and two plaintiffs $(P_1, P_2)$. Each plaintiff has suffered the same injury, say mesothelioma from exposure to asbestos. All three defendants are jointly liable for the injury to each plaintiff. Moreover, for simplicity, assume the share of each defendant's liability to $P_1$ is identical to the share of that defendant's liability to $P_2$. These shares are $(S_1, S_2, S_3)$. The only difference between the two plaintiffs is that $P_1$ sues in period $t$, and $P_2$ in period $t+1$. The only change in the defendants across the two periods is that $D_1$ goes bankrupt between the two periods.

The total liability of the three defendants to $P_1$ is $L_t$, where the subscript indicates that $P_1$ sues on this liability in period $t$. The total liability to $P_2$ is $L_{t+1}$. Because both plaintiffs suffer the same injury, we define the natural growth rate of tort claim values to be $NG = L_{t+1}/L_t$. This growth may be due to discovery of new evidence that suggests the defendants are more culpable than previously thought, to changes in liability rules that makes it easier for a plaintiff to prove her case, to a change in damages rules that makes a greater share of a plaintiff's injury compensable by the defendants, to changes in litigation strategy by the plaintiff that exploits these rules, or to growth in the wages or savings of injured plaintiffs [2].

Assume that the parties are in a jurisdiction with joint and several liability for asbestos poisoning and with a reallocation rule that permits reassignment of all of an insolvent defendant's liabilities to solvent defendants (but not plaintiffs). Moreover, assume no contribution claims are possible against bankrupt entities. The total liability of a solvent defendant, say $D_2$, is $L_{2t} = S_2 L_t$ in period $t$. His liability in period $t+1$ is

$$L_{2t+1} = \left[ S_2 + \frac{S_2}{S_2 + S_3} S_1 \right] L_{t+1} = S_2 \left[ 1 + \frac{S_1}{S_2 + S_3} \right] L_{t+1}. \qquad (1)$$

The second term in each of the brackets reflects the fact that $D_1$ has gone bankrupt. Due to the reallocation rule, his share of the liability to $P_2$ is reassigned to $D_2$ in proportion to his share of liability to $P_2$ relative to other solvent defendants, here just $D_3$. We will define the growth rate of tort claim liability of $D_2$ due to the bankruptcy of $D_1$ to be $BG = S_1/(S_2 + S_3)$

because had $D_1$ not become insolvent, $D_2$'s liability would simply be $S_2 L_{t+1}$. (The bankruptcy-induced growth rate of tort claim values against $D_3$ is the same.)

Suppose that one only observes the tort payment history of solvent defendants, i.e., $\{L_{1t}\}$, $\{L_{2t}, L_{2t+1}\}$ and $\{L_{3t}, L_{3t+1}\}$. This is due to the fact that there are far more plaintiffs than defendants. Through the end of 2003, there were 700,000 plaintiffs compared with 8,000 defendants [6, 7]. Moreover, there are no requirements that plaintiffs report their asbestos gains. As for insolvent defendants, they may enter bankruptcy when their expected liabilities exceed their expected ability to pay into the future. However, it may not be clear for some time how large their actual unpaid liabilities are. In addition, for any plaintiff-insolvent defendant pair, it is unclear who exactly are the jointly liable but solvent defendants. This is not to say data on the tort payment history of solvent defendants is easy to obtain, an issue we will address below, but those data are easier to gather and more informative than other payment data.

The goal of our analysis is to estimate the bankruptcy-induced growth rate of tort claim values for solvent defendants given the tort payment histories of the solvent defendants. This can be accomplished by taking advantage of a basic but important feature of joint and several liability. Although the doctrine may raise the tort liabilities of a solvent defendant once a jointly-liable defendant becomes insolvent, it theoretically does not raise the total tort recovery of any given plaintiff from all solvent defendants. Thus $L_{2t+1} + L_{3t+1} = L_{t+1}$. Therefore, we can estimate the natural growth rate of tort claim values with

$$NG = \frac{L_{t+1}}{L_t} = \frac{L_{2t+1} + L_{3t+1}}{L_{1t} + L_{2t} + L_{3t}}. \tag{2}$$

The other statistic that we can estimate with solvent defendants' tort payment data is the growth rate of any given solvent defendant's tort payments. This growth rate can, as demonstrated in the following equation, be decomposed into the product of the natural growth rate of tort claims values and the growth rate of the value of tort claims against solvent defendants due to the insolvency of jointly liable defendants:

$$G_2 = \frac{L_{2t+1}}{L_{2t}} = \frac{S_2 \left[1 + \frac{S_1}{S_2+S_3}\right]}{S_2} \frac{L_{t+1}}{L_t} = [1 + BG] \times NG \tag{3}$$

(The same is true of the growth rate of $D_3$'s tort payments.) Thus one should be able to estimate the bankruptcy-induced growth rate of tort claims by $BG = (G_2/NG) - 1$, where $NG$ is estimated from (2) and $G_2$ is estimated from (3).

## 2.2 Complications

A number of issues may arise that complicate the calculations from the previous section. For example, what happens if one of the defendants, say $D_2$, is in a joint and several jurisdiction but the other is in a several jurisdiction? Where one defendant, say $D_2$, is in a several liability state, $D_3$ may be solely be held liable for the insolvent defendant's share of the liability. The bankruptcy-induced growth rate in his claim values would be $G_3 = S_1/S_3$. There would be no bankruptcy-induced growth in $D_2$'s claim values. If we calculated separately the bankruptcy-induced growth rate for each solvent defendant, this would be no concern. Because we provide the average bankruptcy-induced growth rate across solvent defendants, however, there will be some error in our estimates. Nevertheless, the greater the number of claims subject to several liability, the lower will be our estimate of this average growth rate. Moreover, any error should be slight because most asbestos injuries occurred before 1979, the year asbestos stopped being manufactured in the U.S., and only three states (Kansas, Vermont, and Wyoming) had deviated from the rule of pure joint and several liability by that point.

Two other issues are analogous in effect to the growth of several liability jurisdictions. These are that some states do not authorize reallocation of an insolvent defendants liabilities to solvent defendants and that defendants who settle for less than their equitable share of liability after reallocation are protected in most states from contribution claims. The existence of joint and several states without reallocation is also subject to the caveat that most asbestos liabilities arising from exposure before 1979 and that most state tort reform statutes that abandon reallocation are adopted in 1986-1987 or the late 1990s. Ultimately, these two issues, like that in the previous paragraph, will appropriately be reflected in a lower estimate of the mean bankruptcy-induced growth rate of claim values.

A second complication is that some courts may interpret their state's reallocation rule to only allow reassignment of unpaid (as opposed to all) liabilities of the insolvent defendant or may permit solvent defendants to seek

contribution from an insolvent defendant's estate — in the case of asbestos liabilities his §524(g) asbestos trust. In that case, the sum of tort payments by solvent defendants is less than the total receipts by the plaintiff: $L_{2t+1} + L_{3t+1} < L_{t+1}L_{t+1} = A_1 + L_{2t+1} + L_{3t+1}$, where $A_1$ is the insolvent defendant's assets available to $P_2$. In order to estimate total receipts by the plaintiff, and thus the natural growth rate of tort claim values, one must include payments by insolvent defendants. This is made difficult by the fact that payments by insolvent defendants may be delayed by many years due to the automatic stay in bankruptcy and that it is difficult to match the date of a payment by solvent defendants with a date of payments by insolvent defendants to the same plaintiff. One factor that limits the impact of this shortcoming in our analysis is that we have found no evidence either of courts permitting only the reassignment of unpaid liabilities of insolvent defendants or of solvent defendants seeking contribution from insolvent defendants.

A related issue is that some states permit reallocation of an insolvent defendant's liability to the plaintiff as well as solvent defendants. This limits the pressure that one defendant's bankruptcy has on the financial status of other defendants. Therefore, it lowers the bankruptcy-induced growth rate of claim values: $BG = S_1/(S_2 + S_3 + S_P)$, where $S_P$ is the plaintiffs share of liability. This reduction should be reflected in our estimates of this growth rate.

A third complication is that there may be a mismatch between the number of claims filed against insolvent defendants and solvent defendant. One reason is that the cost of filing a compensation claim against an asbestos trust formed with an insolvent defendant's assets are lower than the cost of filing a legal claim against a solvent defendant. This may raise the number of claims against an insolvent defendant relative to the number of claims against a jointly liable, solvent defendant. This is widely thought to be the reason, for example, that the Manville Personal Injury Trust was forced to lower the amount it paid on each dollar of liabilities from, e.g., $200,000 in 1988 to $20,000 in 1995 on mesothelioma claims [4, 26, pp. 1323-1325]. A second reason for the mismatch is that, whereas §524(g) trusts tend to have high medical standards that must be met before any claim for compensation is paid, solvent defendants do not apply very high standards for certain types of legal claims filed against it. The explanation is that the cost to the defendant of enforcing these standards for certain — generally non-malignant — injuries is greater than the cost of settling the legal claims. This encourages the filing of questionable if not baseless suits against solvent defendants [26, pp. 1330-

1332].[11]

We do not have the data to determine which effect dominates and therefore which type of defendant attracts more suits. However, our concern is the marginal effect that insolvency of one defendant has on the value of claims against remaining, solvent defendants. Therefore, the growth in the number of claims against asbestos trusts does not concern us. Moreover, baseless filings against a solvent defendant should be unaffected by the bankruptcy of a small number of jointly liable defendants. The gain from such filings is capped by the cost of enforcing certain medical standards. If a large number of defendants declare bankruptcy, settlement values for the relevant injury and any given solvent defendant rise and so solvent defendants may begin enforcing medical standards. The number of claims of the relevant injury against any given solvent defendant will fall, but tort payments on claims proven valid will rise. Because the sum of claim values across defendants, however, will not rise, our estimate of average bankruptcy-induced growth in claim values will pick up the growth rate on claims proven valid.

A fourth complication is that courts may make errors in reallocation. For example, they may under- or overestimate the share of liability owed by insolvent defendants. This is not a serious problem because our goal is not to determine the pressure that joint and several liability theoretically imposes upon a solvent defendant after a jointly-liable defendant goes bankrupt, but to determine the effect that it actually has. This effect includes court errors in reallocation.

[11] The actuarial firm Tillinghast-Towers Perrin estimates that 94 percent of the 52,900 claims filed in 2000 were by nonmalignant claimants. Of the $54 billion that RAND estimates has been spent on asbestos litigation throgh 2001, about 65 percent of the funds – after excluding transactions costs – went to nonmalignant claimants [7, p. vii].

Moreover, a number of studies have found that between two-thirds and 90 percent of claimants are uninpaired. For example, in 1991 a federal judge had medical evidence in 65 asbestos cases filed in the Southern District of Ohio validated by court-selected experts. He found that 64 percent of claimants were free of any actionable condition. Of those the remaining claimants, 85 percent had pleural plaque rather than asbestosis [23, p. 39]. A separate study asked an independent panel of three radiologists to examine x-rays of 439 tire workers who had filed for compensation due to asbestos exposure. They found that only 11 to 16 x-rays — a mere 3.6 percent — suggested evidence consistent with exposure to asbestos [21].

# 3 Estimation and findings

This section describes precisely how we estimate the bankruptcy-induced growth rate between 1990 and 2002. We do not have the data to obtain a precise point-estimate of this growth rate. However, we do have data that permits us to place bounds on this growth rate. Ultimately, we conclude that the bankruptcy-induced growth rate between 5 and 10 percent per annum or between 56 and 157 percent over the entire 1990-2002 period.

## 3.1 Data

We utilize three data sources for our analysis — corporate 10-K filings, Center for Claims Resolution (CCR) resolved claims data, and the RAND asbestos judgment database. 10-K filings of companies with substantial asbestos liability include their aggregate asbestos-related loses (typically indemnity and defense are reported as a single number) and the number of asbestos personal-injury claims they have resolved. Since companies only report this information once their asbestos liabilities have become sizeable, we only have these data for large and relatively mature asbestos defendants. Most of the companies in our 10-K data set are members of the Asbestos Claims Facility, which in turn included most large, mature defendants and is the predecessor of the CCR. The companies on which we have 10-K data report about $15 billion in asbestos-related losses between 1990 and 2002. CCR data provides the number and disease composition of asbestos personal injury claims from 1990 through 2000. Almost every asbestos claimant names at least one member of the CCR. Our final data source is judgments awarded in 689 litigated asbestos personal-injury cases between 1994 and 1998. RAND gathered these data and recorded the judgment date, jurisdiction filed, and the plaintiff's disease. These data are employed to validate our estimates of the natural growth rate of claim values based on 10-K data.

The reader should note that the analysis in this paper focuses on average claim values unconditional on the disease — mesothelioma, asbestosis, lung cancer or pleural plaque. First, although claim values vary substantially across these disease categories, Table 3 illustrates that the distribution of claims against solvent defendants across the four major disease categories — mesothelioma, lung cancer, other cancer, and non-malignant — has remained stable between 1990 and 2000. Further, almost all mature defendants experienced a disease distribution virtually indistinguishable from the aggregate

CCR distribution. Finally, and perhaps most importantly, we assume that the bankruptcy induced growth rate in claims values is independent of disease category. This is reasonable because, for example, the disease distribution of claims against the Manville Personal Injury Trust is not dissimilar to the disease distribution in Table 3 [4, p. 10].

## 3.2 An accounting of payments

Define $S_j$ to be the equitable share of company $j$ and $L_i$ to be the claim value of plaintiff $i$. Total liability of defendant $j$ to plaintiff $i$ is

$$T_{ij} = \left[ S_j + \frac{S_j}{\sum_{\text{named}} S_m} \left( \sum_{\text{bankrupt}} S_m + \sum_{\text{not-named}} S_m \right) \right] L_i \tag{4}$$

The first term captures equitable share. The second term is the the product of (a) the shares of bankrupt companies and companies who are not named in the plaintiff's complaint that are reallocated to solvent and named defendants, respectively, and (b) the share of reallocated liabilities that is assigned to defendant $j$ in particular. The overall share in the square brackets, which we shall call the residual share, is multiplied by the total recovery owed to the plaintiff by all defendants.[12]

Equation (4) is a more precise rendition of (1). The main difference is the inclusion of the reallocated shares of unnamed defendants. The goal of our analysis is to estimate the growth in

$$R_{\text{bank}} = \frac{\sum_{\text{bankrupt}} S_m}{\sum_{\text{named}} S_m}$$

which is the amount reallocated from bankrupt to solvent defendants.

The average payment of defendant $j$ to a single plaintiff is

$$T_{Pj} = \frac{1}{N_{Pj}} \sum_i T_{ij} \tag{5}$$

[12] Actually, payments also reflect the amount not covered by other defendants who settled and the amount below the residual share for which defendant $j$ may settle. Because we will be summing across all relevant defendants, howveer, these terms should cancel.

We assume that shares are constant across plaintiffs. This is technically incorrect, but should not affect our results. If we indexed shares by $i$, we would could use the trick $\sum_i x_i \sum_{ij} y_{ij} = \bar{y} \sum x_i$, where $\bar{y} = \sum_i x_i \sum_{ij} y_{ij} / \sum_i x_i$, and estimate the weighted mean of shares, where the weights were the liabilities owed to different plaintiffs.

where $N_{Pj}$ is the total number of plaintiffs who file an asbestos-related tort suit against defendant $j$. Plugging (4) into (5) yields

$$T_{Pj} = [1 + R_{\text{bank}} + R_{\text{named}}]\, S_j \frac{1}{N_{Pj}} \sum_i L_i \tag{6}$$

where $R_{\text{not-named}} = \sum_{\text{not-named}} S_m / \sum_{\text{named}} S_m$. Because we are interested in changes over time, we shall now index by $t$ and take the ratio of (6) for two consecutive periods:

$$\frac{T_{Pj,t+1}}{T_{Pj,t}} = \frac{[1 + R_{\text{bank},t+1} + R_{\text{not-named},t+1}]}{[1 + R_{\text{bank},t} + R_{\text{not-named},t}]} \times \frac{\bar{L}_{t+1}}{\bar{L}_t} \tag{7}$$

where $\bar{L}_t$ is the total liability owed by all defendants to the average plaintiff. This is independent of the identity of the defendant; variation across payments to a plaintiff by different defendants is fully captured in the share of that plaintiff's liability owed by different defendants. Note that the equitable share of defendant $j$ cancels out because it is unchanged over time; most of these liabilities were generated 40 years before claims were filed [4, p. 3]. The left-hand side term in (7) is the overall growth rate of payments from defendant $j$ to individual plaintiffs. The second term on the right-hand-side is the natural growth rate of tort claims.

We estimate $T_{Pj,t+1}/T_{Pj,t}$ for any given company $j$ on which we have 10-K data with

$$\widehat{\frac{T_{Pj,t+1}}{T_{Pj,t}}} = \frac{\hat{T}_{j,t+1}}{\hat{T}_{j,t}} \frac{\hat{N}_{Pj,t}}{\hat{N}_{Pj,t+1}} \tag{8}$$

where $\hat{N}_{Pj,t}$ is the total number of plaintiffs reported in the company $j$'s 10-K as having settled complaints against it in year $t$, and $\hat{T}_{j,t}$ is the total amount company $j$'s 10-K reported that the company paid in $t$ to resolve asbestos claims.[13] The next subsection discusses precisely how we estimate

[13] We acknowledge that the companies with 10-K filings that provide overall payments to resolve asbestos liabilities are not representative of all companies with asbestos liabilities. In particular, the 10-K companies are larger and more mature defendants. However, we have no reason to think that the growth rate in their per plaintiff payments is higher or lower than the growth rate in such payments by smaller defendants. Moreover, because the larger, more mature asbestos defendants have more at risk, they are more vulnerable, all other things being equal, to bankruptcy. Therefore, the growth rate in their overall claims are more relevant to determining the domino bankruptcy effect of joint and several liability in the asbestos context.

$\bar{L}_t$. In particular, we offer two methods, which we argue give upper and lower bounds for the natural growth rate.

This leaves us with an estimate of

$$\frac{[1 + R_{\text{bank},t+1} + R_{\text{not-named},t+1}]}{[1 + R_{\text{bank},t} + R_{\text{not-named},t}]} = 1 + G_{\text{bank},t+1} + G_{\text{not-named},t+1} \qquad (9)$$

where

$$\begin{aligned} G_{\text{bank},t+1} &= \frac{(R_{\text{bank},t+1} - R_{\text{bank},t})}{[1 + R_{\text{bank},t} + R_{\text{not-named},t}]} \\ G_{\text{not-named},t+1} &= \frac{(R_{\text{not-named},t+1} - R_{\text{not-named},t})}{[1 + R_{\text{bank},t} + R_{\text{not-named},t}]} \end{aligned}$$

are the growth rates of the reallocated shares from bankrupt and unnamed defendants to solvent and named defendants, respectively. Because the number of named companies rises over time, we expect that $G_{\text{named},t+1}$ is negative. Therefore, if we estimate $G_{\text{bank},t+1}$ by simply subtracting one from the left-hand side of (9), we will underestimate the growth in liability shares reallocated from bankrupt to solvent, jointly-liable defendants.

## 3.3 Estimation of natural growth rate

We use two methods to estimate the natural growth rate $\bar{L}_{t+1}/\bar{L}_t$. The first method employs as an estimator of $\bar{L}_t$ proxies for the total payment received by an average asbestos plaintiff in year $t$. One proxy is the total amount a plaintiff received from all defendants in our 10-K sample, assuming that the plaintiff named each defendant in the sample and got the average per-claim payment from each defendant:

$$\widehat{\bar{L}}^{(1a)}_{\text{10-K},t} = \sum_{j\text{-10-K}} \frac{\hat{T}_{j,t}}{\hat{N}_{Pj,t}} \qquad (10)$$

where $\hat{T}_{j,t}$ is the total payment by company $j$ from the 10-K sample in year $t$ and $\hat{N}_{Pj,t}$ is the number of different plaintiffs that settled claims against this company that year. The summation is over all companies in our 10-K sample that were solvent in year $t$. Because this estimator holds constant the number of companies named by the average plaintiff and as naming rises the number of plaintiffs that file claims each company rise, the estimator underestimates the true growth in the natural growth rate.

An alternative proxy for total payment received by the average plaintiff in year $t$ is the mean payment by a defendant to a plaintiff:

$$\widehat{\bar{L}}^{(1b)}_{\text{10-K},y} = \frac{\sum_{j\text{-10-K}} \hat{T}_{j,t}}{\sum_{j\text{-10-K}} \hat{N}_{Pj,t}} \tag{11}$$

This differs from (10) in that it accounts for changes in patterns of naming within our sample of 10-K companies. Because it holds constant naming growth outside the 10-K sample, it will continue to underestimate the true natural growth rate.[14] Therefore, we treat this estimator and the last as lower bounds on the natural growth rate and thus upper bounds on the bankruptcy-induced growth rate. Note that these estimators for $\bar{L}_t$ permit us to calculate the average natural growth rate for the entire sample period.

Our second method for estimating the natural growth rate takes advantage of a "natural" experiment. Between 1994 and 1999 no significant asbestos defendants declared bankruptcy. All other things being equal (which we admit is questionable), the bankruptcy-induced growth rate during the period 1994 to 1998, which we define as the experiment period, should be zero. Therefore, an estimate of the overall growth in claim values during the experiment period provides an estimate of the natural growth rate during the entire 1990-2002 period, assuming this natural growth rate is the same during the experiment and non-experiment period.

Asbestos bankruptcies occurred in two waves in the 1990s. Thirteen asbestos defendants declared bankruptcy between 1989 and 1993 — which we label bankruptcy wave I. Another 27 asbestos defendants declared bankruptcy between 2000 and 2002 — bankruptcy wave II. Table 4 lists major

[14] Because the the number of defendants in our 10-K sample grows over time, however, (11) will yield a lower estimate of the growth than (10).

Although (11) resembles our estimate (8) for the average payment by a defendant to a given plaintiff, it is different in one critical respect. Whereas (8) measures the *growth* in per plaintiff payments *for a given defendant* $j$, the ratio of (11) for two consecutive periods gives the *growth in the average* per plaintiff payment *across defendants*. When a jointly liable defendant files for bankruptcy, if the number of defendants named increases by the number who would have been named but file for bankruptcy, the average payment by a defendant to a plaintiff should not rise because the total amount paid by all defendants does not rise. Thus, if the number of defendants named is constant over time, growth estimates based on (11) should yield a result similar to growth estimates based (10). However, even if the number of defendants is held constant, the reallocated liability may be redistributed among solvent defendants such that each defendant's residual share rises. Equation (8) is formulated to calculate this growth for the individual defendant $j$.

asbestos defendants that declared bankruptcy during each of these waves. Only three asbestos defendants — Lykes Brothers Steamship, Rock Wool Manufacturing, and Rutland Fire Clay — declared bankruptcy between the two waves and they were minor players. Therefore, growth in claim values between 1994 and 1999 should not be related to asbestos bankruptcies.

There is one hitch in our analysis. Although there were no major asbestos bankruptcies, the *Georgine* class action case unfolded during the natural experiment period. The *Georgine* class action was certified in 1993 and dissolved in 1997 by *Amchem Products v. Windsor*. The uncertainty created by *Georgine* impacted all asbestos defendants. For example, the CCR settled about five times as many claims in both 1993 and 1998 than it settled in any year in between. More importantly, most asbestos defendants experienced a transitory spike in claim values after *Georgine* was dissolved. Because we define the natural experiment period to end in 1998, the spike in 1997 and 1998 claim values following the dissolution of *Georgine* inflates the growth in claim values during the experiment period. Therefore, the natural experiment estimator resembles an upper bound on the natural growth rate, which translates into a lower bound on the bankruptcy-induced growth rate.[15]

We calculate the mean overall growth rate during the experimental period using (8) and using data on median court judgments in asbestos cases from joint and several jurisdictions. The latter is a valid estimate of the natural growth rate because defendants in court cases from joint and several liability jurisdictions are assigned the aggregate liability owed by all defendants to any plaintiff.[16]

## 3.4 Estimates

The company-specific annual growth rates in payment by individual defendants to individual plaintiffs during each bankruptcy wave are listed in Ta-

[15] It is not precisely an upper bound because, altough there may not have been any bankruptcy-induced growth in claim values during the natural experiment period, there was likely a reduction in claim values as the number of named defendants rose. This tends to depress overall growth and thus our estimates of natural growth. However, we believe, based on time-series of claim values, that the bias from including the *Georgine* class action during the natural experiment period dwarfs the effect from naming.

[16] In several liability jurisdictions, defendants are only assigned their proportionate share, which reflects the natural growth rate so long as defendants equitable shares or defendant composition does not change over time.

ble 6. The combination of these growth rates, the estimated nominal natural growth rate, and equations (7) and (9) identify the bankruptcy-induced growth rates for each company.

The second and third columns of Table 5 display our estimates of the annual natural growth rate in claim values resulting from each of the estimators described above. The second column presents the growth rate in nominal dollars, while the third presents the growth rate in real dollars. The two proxies for the total payment received by the average plaintiff suggest a natural growth rate of 2.9 and zero percent, respectively, in nominal terms. Both natural experiment estimators suggests a natural growth rate of 8.5 percent in nominal terms. In real terms, estimates of the natural growth rate fall between minus three percent and six percent.

Figure 2 illustrates why we estimate zero real growth from aggregate payments. Total payments increased by 33 percent from 1991 to 2001. However, inflation was 30 percent over this period. Therefore, this measure of payments indicates positive nominal growth in plaintiff claim values, but close to zero real growth. Figure 3 illustrates why we estimate zero nominal growth from the estimator in (11). The average payment by each settling defendant ranges from $3,000 to $4,500 and has no pattern over time. Thus, although these companies are a select subset of asbestos defendants, the average nominal settlement value across these companies does not grow over time.

Finally, on a company-by-company basis, average payment per settled claim rose 38 percent for companies in the 10-K data set during the experiment period. We get an identical estimate of mean awards per plaintiff from our judgments data. This is equivalent to an average of 8.5 percent growth annually. Inflation over this period averaged 2.4 percent annually, resulting in 6.1 percent real growth.

The final three columns of Table 5 present the bankruptcy-induced growth rates from bankruptcy wave I, bankruptcy wave II, and the combined impact of both bankruptcy waves. These estimates employ a weighted average of the growth in payments by individual companies to individual plaintiffs from Table 6, where the weights are the size of each company's mean payments.[17] Allowing for the highest estimated natural nominal growth rate of 8.5 percent

[17] Using a straight average across companies has no impact on the bankruptcy-induced growth rate during bankruptcy wave I, but increases the growth rate during wave II by about 30 percentage points.

annually, the two bankruptcy waves combined to increase claim values 56 percent. With zero real or zero nominal natural growth in claim values, the two bankruptcy waves combined to increase defendant-specific claim values by 157 percent or 200 percent, respectively. Based on these findings, we conclude that the true bankruptcy-induced growth rate is likely to lie between 56 and 157 percent.[18]

## 3.5 Analysis

Our findings suggest that the bankruptcies of asbestos defendants in the 1990s substantially increased the asbestos liabilities of solvent defendants. In particular, these bankruptcies increased the value of asbestos-related claims at least 56 to 157 percent by 2002, which translates to annual bankruptcy-induced growth of 5 to 10 percent. We say "at least" because plaintiffs named an increasing number of defendants per complaint during the 1990s and, as we explained in the discussion after equation (9), this depresses the overall growth rate of per-claim payments by individual defendants once purged of the natural growth rate of the value of these claims. Of course these numbers mask a large number of bankruptcies, specifically 7 in wave I and 30 in wave II. Although the exact impact of any given bankruptcy on the value of claims against remaining defendants depends on the aggregate liabilities (and theoretically, assets) of the bankrupt entity, we can estimate the mean effect of any given bankruptcy. These are 3.7 to 8.8 percent per bankruptcy in wave I and 0.6 to 1.6 percent per bankruptcy in wave II. The reason for the reduction in the marginal impact of growth is likely the fact that earlier bankruptcies involved larger defendants and that the number of companies named by plaintiffs rose over time.

Because the bankruptcy of a defendant raises the liabilities, but not the assets, of jointly liable, solvent defendants, it increases the pressure on the latter to also file for bankruptcy. Of course the exact amount of pressure depends on two omitted variables: the amount of solvent defendants' assets and the number of claims filed. The former is difficult to estimate in the asbestos context, not just because it is difficult to get precise values for a corporation's unsecured assets, but because joint and several liability is

[18] We use 157 percent estimate from the aggregate payment estimator rather than 200 percent estimate from the average claim value estimator because both estimators purport to give us upper bounds on the natural growth rate and the aggregate payment estimator is the lower of the upper bounds.

piggy-backed on an underlying theory of liability that permits plaintiffs to attack any parties in the chain of distribution for asbestos. Therefore, it is very difficult to identify all possible defendants whose assets could be used to satisfy tort claims. (Indeed, given the widespread use of asbestos, the number of defendants may be quite large. Recall that over 8000 different companies have already been sued.)

However, it is possible to obtain data on the number of claims filed annually. For example, the average number of filings against the 17 companies we have 10-K data for has grown from 7,317 in 1990 to 34,026 in 2002, equivalent to a compound rate of 13.7 percent. Our estimate is consistent with those from other sources [7, p. 42]. Because the aggregate liability is the product of the number of claims filed and the value of claims filed, growth in liability is the product of the percentage growth in filings and claim values. (So, e.g., if filings double and claim values double, overall payments quadruple.)

# 4 Conclusion

The primary contribution of this paper is concrete evidence that, because of joint and several liability, the bankruptcy of one defendant places significant pressure on the financial status of jointly liable but still solvent defendants. A second, but equally important, contribution is that it undercuts the claim that tort claimants are undercompensated because defendants may be judgment proof. When the liability is shared — in a joint and several sense — between a judgment-proof and a solvent defendant, the tort claimant appears to recover at least a portion of her claim against the insolvent defendant from the solvent defendant. The extent of the reallocation is uncertain. However, our estimate of the share of aggregate liabilities that have been reassigned — at least one-third to three-fifths[19] — are not implausible estimates of the share of aggregate liability owed companies who went bankrupt in the 1990s.

This finding is relevant to calls in the bankruptcy literature for raising the effective priority of tort claimants. These proposals include simply elevating the formal priority of tort claimants in bankruptcy [19, 20, 16]; eliminat-

[19] This is calculated as follows. Suppose there are two defendant with constant liabilities shares of $S_1$ and $S_2$, respectively, over time. If the first defendant goes bankrupt, then the second, solvent defendant's liability share — holding constant natural growth — increases from $S_2$ to $S_1 + S_2 = 1$, or at a rate of $g = S_1/S_2$. Therefore, the first defendant's share is $S_1 = g/(1+g)$.

ing the corporate veil for tort claims [12] so that in the even of a corporate bankruptcy the tort victim can seek compensation pro rata from shareholders; not discharging tort claims in bankruptcy [5]; and requiring companies to purchase insurance to cover the risk of insolvency to tort claimants [**?**]. The logic behind these reforms is that tort claimants may not be efficient bearers of the risk that the tortfeasor may become insolvent. Because the tort claimant, unlike other creditors, is unable to contract with the tortfeasor before the tort occurs, the parties cannot voluntarily allocate the risk to the tortfeasor when efficient. The bankruptcy court can solve this problem either by raising its estimate of tort claim values or, equivalently, raising the priority of tort claimants. This simply reallocates some of the risk of insolvency to other creditors, who are able to contract for this ex ante. A second reason for raising the effective priority of tort claimants is that these other creditors may find it more cost effective to monitor the tortfeasor's behavior so as to limit the probability of the tort than to provide insurance for the additional risk associated with raising the priority of tort claimants. In that case, the tort claimant is less likely to be injured in the first place [19, pp. 1052-1054].

Our analysis suggests that this reallocation of risk is unnecessary where the tort committed is subject to the rule of joint and several liability. Under this condition, the risk of insolvency is in practice reallocated to solvent, jointly liable defendants. To the extent that joint and several reallocation takes into account superpriority in bankruptcy, i.e., tort courts reallocate only the unpaid portion (as opposed to all) of the insolvent firm's tort liability, superpriority will simply redistribute risk from solvent joint defendants and to other creditors. Such a redistribution appears neither to serve the goal of monitoring or to promote fairness. If joint and several liability reallocation does not take into account superpriority, then superpriority will exacerbate the potential for double recovery by tort claimants from solvent joint defendants. If tort courts do not credit solvent defendants payments made by insolvent defendants pursuant to a claim, then the solvent defendants must seek contribution from insolvent defendants. If transactions costs prevent this, tort claimants may double recover for a portion of their injuries. The larger these claimants' recovery from the insolvent entity, the larger that double recovery. Although this paper does not quantify the extent of double recovery, if any, we hope in future research to determine whether it occurs in practice.

This paper is also relevant to the debate over how the U.S. should manage

mass the resolution of tort liabilities. There are three primary approaches advocated in the academic literature: class actions, bankruptcy, and a legislative trust fund. Advocates for class actions argue that it is less costly than individual-by-individual litigation. It also offers defendants a final resolution of their liabilities [22]. The difficulty is that the Supreme Court in *Amchem Products Inc. v. Windsor* (1997) and *Ortiz v. Fibreboard Corp.* (1999) refused to certify a class in asbestos cases because, among other things, future claimants would not be adequately represented. Advocates of the bankruptcy mechanism argue that it offers better procedural protections for future claimants than class actions [8, pp. 1457-1461]. Indeed, Congress has codified these in §524(g) of the Bankruptcy Act. However, this protection has been criticized as less than adequate. For example, while the Code authorizes a future claimants representative in §1109(b), votes of 75 percent of existing claimants are sufficient to confirm a reorganization plan. This tilts the ultimate outcome in favor of present claimants [27, p. 53]. Moreover, future claimants are still bear a disproportionate amount of the risk associated assets of the §524(g) trust because they are compensated later than present claimants [15]. Few scholars argue against a legislative solution. The difficulty lies in determining the appropriate amount of funding for a government trust and allocating those costs between defendant companies and their insurers. So far these efforts have proven unsuccessful.

While we understand the merits of — and indeed subscribe to — a national workers compensation-type solution, the findings in this paper suggests a fourth approach to mass tort: where liability is joint and several, let the tort system continue to manage compensation. There is no evidence that claimants from 2002 fare any worse than those from the 1990s. When a defendant goes bankrupt, other solvent defendants appear to end up bearing a sizeable amount of unpaid liabilities. The tort system is not perfect. It has been criticized, e.g., for the amount of legal fees it generates. Some estimates put these fees as high as 65 percent of total payments by defendants. But this criticism may also be leveled at class action settlements[20] and, to

[20]But see [**?**].

The tort system may also be criticized for burdening plaintiffs with the risk that the total assets of all theoretically culpable defendants under even the joint and several rule is insufficient to cover the cost of all asbestos injuries. But this is a criticism that complicates all approaches to mass tort. Settlements are limited by available defendants and assets. Plaintiffs may actually do worse in bankruptcy because they have to share unsecured asets with ordinary unsecured creditors. Finally, the fact of a limited amount of assets suggest

some degree, at bankruptcy. Our point is only that the tort system may not be as imperfect as many scholars suggest when it comes to insuring victims of torts subject to joint and several liability from the risk of insolvency.

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that any legislative solution that fully compensates injured plaintiffs must be funded to some extent by general revenues of the government.

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Table 1: Liability for asbestos exposure in the 50 states and D.C.

| State | Liability rule for asbestos claims (D is defendant, P is plaintiff) | To whom may insolvent's liability be reallocated? |
|---|---|---|
| AK | Pure J&S | D |
| AL | Pure J&S | D |
| AR | Pure J&S | D |
| AZ | Several | |
| CA | J&S for econ. damages | |
| CO | Several | |
| CT | J&S for econ. damages | D (econ. damages) |
| DC | Pure J&S | D |
| DE | Pure J&S | D |
| FL | J&S for econ. damages up to flexible cap | |
| GA | J&S if plaintiff w/o fault | |
| IA | J&S for econ. damages if share > 50% | |
| ID | Several | |
| IL | J&S if share > 25% | |
| IN | Several | |
| HI | Pure J&S | D |
| KS | Several | |
| KY | Several | |
| LA | Several | |
| MA | Pure J&S | D |
| MD | Pure J&S | D |
| ME | Pure J&S | D |
| MI | Several | |
| MN | J&S (but if below 15% share, liable only up to 4x share) | D, P |
| MO | J&S if plaintiff w/o fault | D and (if P is at fault) P |
| MS | J&S below 50% of total damages | |
| MT | J&S if share > 50% | D if share > 50% |
| NC | Pure J&S | D |
| ND | Several | |
| NE | J&S for econ. damages | |
| NH | Pure J&S or J&S if share > 50% | |
| NJ | J&S if share > 5% to 60% | |
| NM | Several | |
| NV | Pure J&S | D |
| NY | Pure J&S | D |
| OH | J&S for econ. damages if share > 50% | |
| OK | J&S if plaintiff w/o fault | |
| OR | J&S for econ. damages if share > 15% and > P's share | D if share > 25% and > P's share |
| PA | Pure J&S | D |
| RI | Pure J&S | D |
| SC | Pure J&S | D |
| SD | J&S (liable only up to 2x share) | D |
| TN | Several | |
| TX | J&S if P's share < sum of Ds' shares | |
| UT | Several | D (if insolvent's share < 40%) |
| VA | Pure J&S | D |
| VT | Several | |
| WA | Pure J&S | D |
| WI | J&S if share > 51% | |
| WV | Pure J&S | D |
| WY | Several | |

Table 2: Contribution rules based nature and size of payments by defendants and by solvency of defendants.

| | | Judgment | | Settlement | | Insolvency | |
|---|---|---|---|---|---|---|---|
| | | $J_2 < L_2$ | $J_2 > L_2$ | $S_2 < L_2$ | $S_2 > L_2$ | $A_2 < L_2$ | $L_2 < A_2 < L$ |
| Judgment | $J_1 < L_1$ | No contribution. | | | | | |
| | $J_1 > L_1$ | Contribution against $D_2$ (but $J_2 = 0$ maybe required). | Set-off rule should avoid this. | | | | |
| Settlement | $S_1 < L_1$ | No contribution. | No contribution. | No contribution. | | | |
| | $S_1 > L_1$ | Contribution against $D_2$ (but $J_2 = 0$ maybe required). | Set-off rule should avoid this. | No contribution against $D_2$ unless P releases $D_2$ from liability. | Bad bargaining by defendants. No contribution. | | |
| Insolvency | $A_1 < L_1$ | No contribution against $D_1$. | Possible only if reallocation. Contribution from $D_1$ estate permitted (but $J_2 = L$ maybe required). | No contribution. | Contribution from $D_1$ estate (but $S_2 = L$ maybe required). | No contribution. | |
| | $L_1 < A_1 < L$ (assume $D_2$ moves first) | Contribution against $D_2$ (but $J_2 = 0$ maybe required). | Not possible. | No contribution. | Not possible. | Uncertain. | No contribution. |

Table 3: Distribution of claims across disease-types, by year of settlement, 1990-2000.

| Year of settlement | Percent of claims by disease | | | |
|---|---|---|---|---|
| | Non-malignant | Other cancer | Lung cancer | Mesothelioma |
| **1990** | 85.89% | 2.01% | 7.60% | 4.51% |
| **1991** | 88.30% | 1.44% | 6.59% | 3.66% |
| **1992** | 84.35% | 3.26% | 8.79% | 3.60% |
| **1993** | 88.87% | 1.80% | 6.57% | 2.77% |
| **1994** | 86.09% | 2.56% | 7.54% | 3.81% |
| **1995** | 85.42% | 1.81% | 7.41% | 5.36% |
| **1996** | 86.74% | 2.00% | 6.85% | 4.41% |
| **1997** | 83.66% | 2.53% | 7.83% | 5.99% |
| **1998** | 87.46% | 1.92% | 6.54% | 4.07% |
| **1999** | 91.02% | 1.57% | 4.73% | 2.67% |
| **2000** | 86.55% | 2.37% | 6.66% | 4.43% |

Table 4: Timing of major asbestos-related bankruptcies during 1990-2002.

| Bankruptcy wave | Company | Year of bankruptcy |
|---|---|---|
| Wave I | Raybestos | 1989 |
| | Celotex (Carey Canada) | 1990 |
| | National Gypsum | 1990 |
| | Eagle Picher Industries | 1991 |
| | Keene Corporation | 1993 |
| Wave II | Armstrong World Industries | 2000 |
| | Babcock & Wilcox | 2000 |
| | GAF Corporation | 2000 |
| | Owens Corning/Fibreboard | 2000 |
| | Pittsburgh Corning | 2000 |
| | Federal Modul | 2001 |
| | USG | 2001 |
| | W.R. Grace | 2001 |
| | AC&S | 2002 |
| | Harbison Walker Refractory Company | 2002 |
| | Kaiser Aluminum and Chemical Company | 2002 |
| | North American Refractories | 2002 |

Table 5: Estimates of the natural and bankruptcy-induced growth rate.

| Technique | Annual natural growth rate | | Bankruptcy-induced real growth rate | | |
|---|---|---|---|---|---|
| | Real | Nominal | Wave 1 | Wave 2 | Com-bined |
| 1a - aggregate payment | 0.2% | 2.9% | 62% | 59% | 157% |
| 1b - average payment | -2.7% | 0.0% | 75% | 72% | 200% |
| 1994 to 1999 "natural" experiment | 6.1% | 8.5% | 26% | 24% | 56% |

Table 6: Company-specific growth in claim values.

| Company | Ave. annual growth in nominal claim values | | |
|---|---|---|---|
| | Wave 1 | Interim | Wave 2 |
| Grace | -10% | 18% | 17% |
| FWC | 52% | -7% | 32% |
| CCK | 5% | 4% | 34% |
| Coltec | -2% | -7% | 35% |
| GP | 24% | 17% | 36% |
| B&W | 33% | 9% | 0% |
| OI | 38% | 22% | -10% |
| ABB | n/a | -3% | 10% |
| Kaiser | 0% | 3% | 42% |
| HAL | -10% | -17% | 37% |
| Weighted ave. | 17% | 9% | 17% |

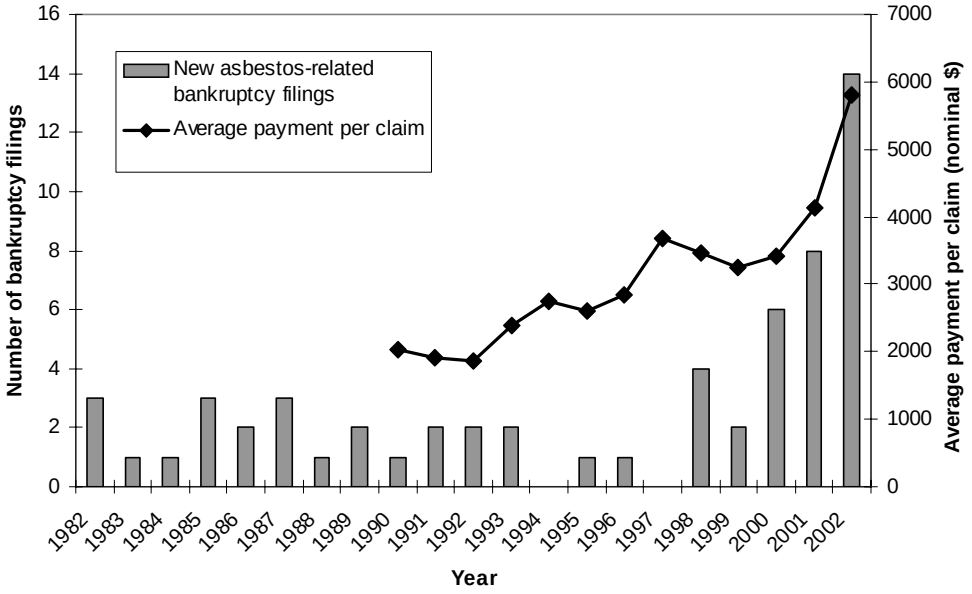


Figure 1: New asbestos-related bankruptcy filings per year and the average payment per tort claim by certain large asbestos defendant companies, 1982-2002. (Average payment is per company for seven large asbestos defendants who are in our 10-K data set and solvent for the entire period from 1990-2002.)

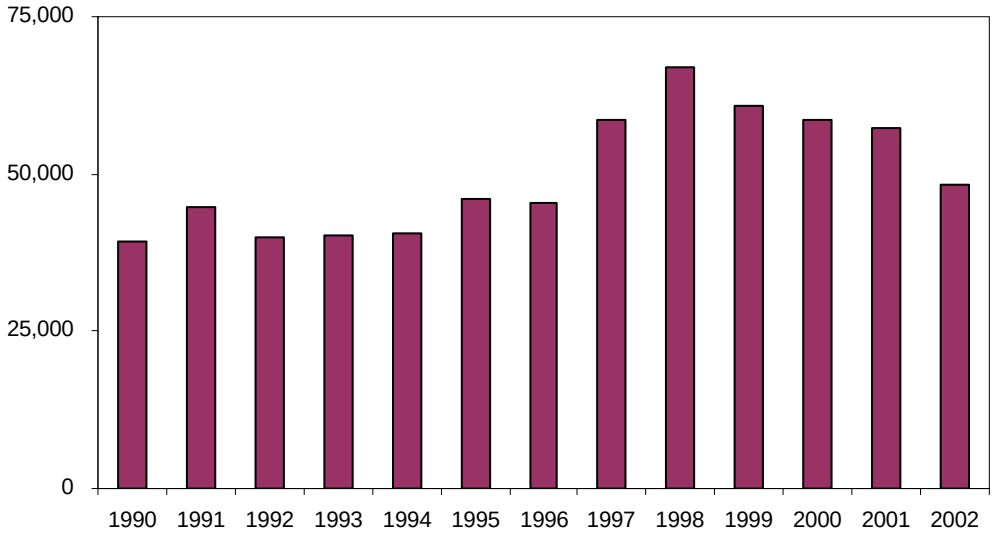


Figure 2: Total asbestos liability costs across all companies in 10-K data set, by year, 1990-2002.

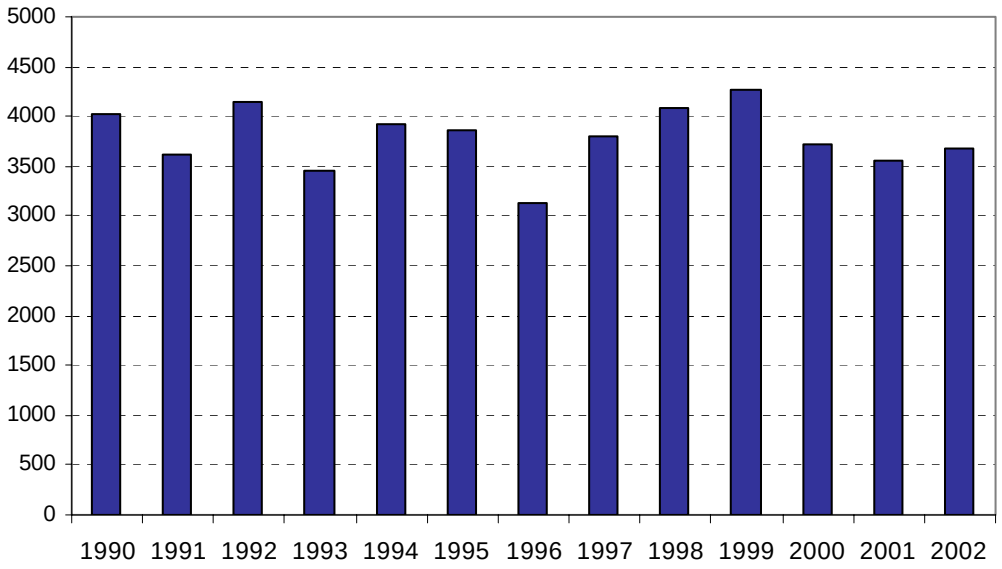


Figure 3: Average claim values of companies in 10-K data set (including defense costs and dismissals), by year, 1990-2002.