Informational externalities and informational sharing in class action suits

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Abstract

When several plaintiffs file individually a lawsuit against the same tort-feasor, the resolution of the various cases through repeated trials produces positive informational externalities, which benefit to the later plaintiffs (since there exist precedents, jurisprudence...). Thus, the first filers may have an incentive to initiate a class action as far as it enables the various plaintiffs to share their information. This feature has not been stressed in the literature, and in contrast strategic uses of class actions have been studied in more details (Che (1996), Marceau and Mongrain (2003)).

In this paper, we elaborate on a basic strategic model of litigation settlement, focusing on the interactions between the characteristics of the discovery process (as a general technology of production of evidences) in mass tort litigation, those of the compensation rules set by Courts, and the structure of litigation costs, in order to study when a class action fails to occur, and when sequential trials are more likely.

We consider the case of a perfect discovery process. We provide sufficient conditions under which a class action is formed. We show that when victims have heterogeneous claims, the compensatory damages rule awarded by Courts is of major importance for the formation of the class action, whatever the degree of heterogeneity: all else equal, there always exists a degree of *damage averaging* under which the class action occurs. We also show that when contingent fees are used to reward attorneys' services, plaintiffs become neutral to the arrival of new information on their case.

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1 Introduction

There is a general agreement concerning two effects associated to the formation of a class action (CA therafter).

On the one hand, CA entail aggregation and amplification effects, which are both individually and socially desirable. In practice, CA are used to consolidate a large number of individual claims: and specifically CA are first designed to encompass the smaller claims that otherwise would not obtain compensation. It is well known that individual rationality implies that, the smaller claims under a threshold depending on the litigation cost, are deterred from filling an individual lawsuit, and thus never obtain compensatory damages. Thus, to the extent that CA entail a decrease in the litigation cost, smaller claims are allowed to enter into the litigation process, which is beneficial for them. Moreover, once both the larger and the smaller claim file a suit against the same tortfeasor, he receives additional incentives to undertake the socially efficient level of care. This is because CA are supposed to lead to an increase in the probability of lawsuit, given that when some victims are deterred from filling a individual suit, the defendant's probability of being sued is smaller than one, and he does not have enough incentives to invest in the prevention activity. As a result, CA also contribute to improve the preventive function of tort law.

On the second hand, CA are the source of significant scales economies. Filling a suit against a large tortfeasor (firm) may be quite complex and expensive for an individual: it implies a waist of time, energy and various resources which may be very expensive as compared to the capacity of the tortfeasor – such that a small plaintiff may discouraged to fill against a large tortfeasor. In contrast, a CA allows a decrease in litigation cost per individual, or allows plaintiffs to invest in better experts than they did in the absence of class action (since the cost is spread over all the members). Eventually, members of a CA may be specialized on some tasks depending on their skill. Adding to these individual or internal scales economies, there also exist some external or aggregate scales economies. CA also entail a reduction of the number of individual court's appearances, which is first beneficial for the members of the CA. But, it also induces an improvement in the public services of justice: once a CA is initiated, the rate at which all claims are resolved is increased. In words, CA are supposed to have positive effects on the congestion externalities of public services of justice.

Thus, the basic incentives to initiate and or join a CA identified in the literature mainly depend on the value of 3 key parameters ; CA are more likely when :

- the number of individuals similarly situated with respect to a common defendant is very large.

- the loss borne by each party is relatively small.

- the administrative costs of individual suit are quite high.

Nevertheless, some authors have suggested that members of the CA may also develop opportunistic or strategic behaviours. Two papers have best formalized the idea that a CA formation creates a situation of strategic interaction between plaintiffs. Che (1996) focuses on the role of asymmetries of informa-

tion, when asymmetries exist both between plaintiffs and the defendant, and simultaneously between the members of a CA. Che assumes that two kinds of plaintiffs (small claim, and large claim) sue against the same tortfeasor, and have the opportunity to join a CA or to file individually; His question is: what are the characteristics of the CA members? Specifically, Che analyses the occurrence of two main market failures: either no CA is formed, while there exists a potentially viable CA, or not all the plaintiffs are allowed to join the CA (and specifically, not all the smallest or weakest victims), but many opt out. Che finds a multiplicity of equilibria, which globally confirm the prevalence of these inefficiencies; his findings show that the characteristics of each equilibrium, that is the composition of the CA, depends on the proportion of large stake in the population of plaintiffs.

Marceau and Mongrain (2003) develop the idea that a CA has the characteristics of a public good: in most jurisdictions where they are allowed (Canada and United Sates), a CA is roughly speaking a non-rival and a non excludable good; but this a public good which is privately produced, because a CA is usually provided by a only a subset of plaintiffs (in their analysis, a single plaintiff): once the CA is created against a tortfeasor, all the victims have the opportunity to join it, and thus benefit from the provision of the good without having to incur the initial cost associated to the formation of the CA: this cost corresponds to the various expenditures (in time and financial resources) required to coordinate the various individual claims. For the representative member, this cost is a sunk cost, and it is borne only by the initiator of the CA. Hence, given that for everyone it is better to join a CA already formed than to initiate it, there is a problem of "free-riding", which is formalized by Marceau and Mongrain as a war of attrition: on the one hand, each plaintiff has an incentive to wait that someone else initiates the CA (because of the sunk cost) but on the second, he bears a penalty in waiting (time is also costly). The findings of Marceau and Mongrain show that the identity of the CA initiator depends on the rule of compensation awarded by courts to the CA members: small levels of damage averaging tend to give incentives to the holder of the smallest claim to be the initiator of the CA. Two other results are worth mentioning: first, when they introduce the existence of "nuisance suits" or small claims that would be deterred from an individual suit, M and M show that these individuals are passive members: they join the CA but never initiate it; second, they find that a large CA never occurs, that is the largest claims have always an incentive to opt out the CA and to sue individually.

The existence of informational asymmetries, or the fact that a CA has the characteristics of a club good are certainly important since they explain that the exclusion of some plaintiffs may arise, and specifically the weakest victims. Nevertheless, it seems that another argument should counterbalance these effects, but as far as we are aware, it has not been yet formally investigated. Our starting point is that when parties enter into the litigation process, they also access to a discovery process: before going to trial, arties collect evidences, testimonies, expertises and so on. And they share some information during the pretrial negotiation period; eventually, the plaintiff and the defendant will con-

verge towards the same assessment of the outcome at trial; this is well known;

But there are many reasons explaining that plaintiffs also share, voluntary or not, the information they have collected, although they are engaged in individual lawsuits against the same defendant: this is the case for example, when several victims are injured by the same tortfeasor, not in the same accidental event but after several accidents in a quite long period of time (think of : asbestos litigation, lawsuits against tobacco industry, medicine malpractice, or product liability . . .). In this case, plaintiffs do not enter simultaneously (at the same date) into the litigation process, but they enter sequentially (at different dates). Hence, they have access to different information but this does not reflect informational asymmetries per se, but incomplete information for the first plaintiffs, since as time is passing, new or more robust evidences arrive, less controversial scientific proofs are available.

As a result, some uncertainty is quite « naturally » resolved between the period where the first claims are settled and the period where the later plaintiffs file, meaning that there exist positive informational externalities between plaintiffs, which normally arise when similar individual cases are successively resolved by courts; later fillers may benefit from the experience of the first plaintiffs because of the jurisprudence, or the influence of precedents on the behaviour of courts. On the other hand, these informational externalities allow later plaintiffs to update their beliefs on the likelihood to win at trial, and thus they may undertake more accurate decisions.

According to this view, CA may be understood as a useful tool used by plaintiffs to internalise these positive externalities of information. Specifically, CA allow the earlier victims to retain part of the benefits of these externalities, that otherwise they would never recover. We can imagine that the CA's attorney play an active role in the transmission of information between the members: the economies of scales associated to the pooling of attorney's service (usual argument) which have an effect on the litigation cost per individual are also associated to informational externalities which are important to assess the expected gain at trial. More specifically, when they become members of a CA, plaintiffs become aware of the existence of the correlation between the individual losses; this new information may induce plaintiffs to become more confident with their chances of success at trial against the same defendant! More generally, plaintiffs are necessarily led to update their initial beliefs corresponding to the likelihood that the defendant is liable.

In our work, we focus on the impact of information sharing between plaintiffs, and we compare the case where CA are forbidden, to the case where they are allowed. We also add another feature: we think that main informational asymmetries exist not between parties opposed in a litigation, but between on the one hand both parties opposed at trial, and on the other the judge. In many countries (both under common law and civil law) procedural rules hold such that parties opposed in a litigation have a legal right to the discovery, that is each party has a free access to the evidences and the various documents that the other party has gathered and will produce at trial: hence, there is a legal impossibility of "news" at trial. In contrast, some empirical works display that

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there exist kind of heterogeneity in the decisions of courts, concerning similar cases they have had to resolve. So once the parties have collected evidences, testimonies and so on, a great uncertainty remains as to the outcome at trial: what will be the decision of the judge? A related problem is the emergence of new legal doctrines. For example in the United States, the problem with the asbestos litigation in the eighty's comes partly from the fact that the legal doctrines to apply was not yet developed. So in our work, the main source of uncertainty is coming from the attitude of courts.

In the rest of the paper, we exhibit the importance of three main features concerning the issue of CA formation, when there exist (positive) informational externalities between plaintiffs filing a suit against the same tortfeasor: the characteristics of the discovery process (the technology of production of information: evidences, testimonies, expertises . . .), those of the compensation rules set by courts (individual damage for individual suits or damage averaging for class action), and the size of scales economies on the litigation costs, in order to exhibit sufficient conditions under which a class action is formed allowing plaintiffs to share their information. Section 2 describes the simple model. We characterize in section 3, a set of (subgame perfect) equilibria associated to the existence of the large class action (including both types of plaintiffs). We show that when plaintiffs expect to never obtain "bad news", a sufficient condition in order that they file is that their priors are "optimistic". More specifically, we show that when plaintiffs expect to obtain at least one "good news" in the future, such a class action is more likely to occur the smaller the proportion of plaintiffs having the small stake and the larger the scales economies on the litigation costs. Finally in section 4, we analyse the impact of alternative rules of attorney's fees (fixed payments, contingent fees, payments proportional to the value of the case).

2   The basic set up

2.1   basic motivations

Consider a situation where the same individual, for example through the occurrence of several successive individual accidents, injures a group of victims. If class actions are legally forbidden, (all or only some of these) victims will enter sequentially into the litigation process, and will file individually against this tortfeasor. In this case, it is natural to consider that repeated trials entail positive informational externalities which are beneficial only to the later plaintiffs : the earlier plaintiffs who have worse or less fine information may undertake actions that otherwise they would not choose to follow had they obtained better information. In contrast, the plaintiffs who enter later on in the litigation process may benefit of the experience of the earlier ones (either because of the jurisprudence, or because of the existence of precedents), and are allowed to undertake more accurate decisions regarding the various legal options, which are available (file or exit; go to trial, settle amicably or give up).

This correspond to a kind of passive transmission of information coming from the earlier plaintiffs, or a case of non-voluntary information sharing, but a problem arises because the first plaintiffs have no means to benefit of the information collected by their successors or to retain privately part of the benefits associated to the positive informational externality they create. In this spirit, the formation of a class action may be understood as a tool allowing to internalise these externalities : it allows the earlier plaintiffs to benefit of the existence of positive informational externalities that otherwise they would never recover when only individual suits are possible. More generally, we can easily imagine that the formation of a class action makes easier the transmission of information between the plaintiffs. For example, when they become members of a class action, plaintiffs become aware of the existence of a correlation between the individual losses, and this new information may induce them to become more confident with their chances of success at trial against the defendant. As a consequence, apart of economies of scales coming from the pooling of attorney's services, there exist strong incentives in favour of the formation of a class action which result from information sharing between plaintiffs : specifically, the pooling of individual information allows all of them to improve their individual assessment of the expected gain at trial.

In this paper we focus on these incentives to share information between plaintiffs suing the same tortfeasor, and we investigate their consequences for the existence of a class action. In our set up, the characteristic features of the available information (the discovery process) are such that:

1. whatever the available information, plaintiffs are not confident with respect to their chances of success at trial, i.e. they can not know whether the judge will be favourable to their case; on the one and, it is relatively easy to assess the value of individual damages (which may be considered as a public information), but on the second, the cause of the victims' injury may be quite difficult or costly to establish; thus, the plaintiffs' individual assessment of the likelihood to win at trial are always smaller than 1.

2. before entering into the litigation process, all (types of) plaintiffs have common priors (same initial assessment of the likelihood that they will win at trial); but when they file a suit, and since they enter at different dates into the discovery process, they obtain different additional information: more specifically, the later the entry into the litigation process, the finer the information obtained; given that the new information allows each plaintiff to update his initial beliefs, this explains why the different types of plaintiffs have different posteriors beliefs;

3. the defendant has access to the same information as the plaintiff, for any date in the litigation process; in practice, legal arrangements guarantee him the rights of discovery; for example, in many countries, there exists a legal impossibility of "news" or "surprises" at trial: each party has a free access to the evidences and the various documents that the other party has gathered and will produce at trial.

4. each plaintiff evaluates (ex ante) the opportunity to file a suit or to give up, knowing that he will benefit of a new information later on once he will be

engaged in the litigation process, and knowing that this information will give a new assessment of his chances at trial, such that he will undertake ex post the best decision (whether he exits, goes to trial or accepts the defendant's offer) conditionally on his information.

This way, we capture two salient characteristics of the litigation process: i) In practice, main informational asymmetries exist between on the one hand the judge, and on the second both parties opposed at trial. Thus, the main relevant source of uncertainty for parties is explainable by the behaviour and ultimate decision of the judge at trial, which is not known ex ante. In contrast, the pre-trial negotiation period leads to the revelation of the relevant private information between parties – given the existence of a legal impossibility of "news" or "surprises" at trial. ii) There are several reasons explaining why most of the time, plaintiffs cannot have the certainty to win at trial:

- scientific evidences may not allow concluding with certainty, but consisting in known or likely causalities associated to statistical frequencies, or intervals of probabilities,

- some evidences may be strongly controversial, and always in the scientific debate,

- there may exist a large disagreement between experts' opinions, and obviously between the plaintiff's experts and those of the defendant,

- finally, we can also take into account human mistakes when information is ambiguous, and introduce for example the possibility that judges may have bias of judgment, mistaken beliefs, and/or that they unfortunately reject some pieces of evidences.

A related problem concerning collective accidents and mass tort class action is the emergence of new legal doctrines, which creates hard uncertainty for parties. For example in the United States, the problem with the asbestos litigation in the eighty's comes partly from the fact that the legal doctrines to apply was not yet developed.

Formally, we introduce this problem of information arrival and beliefs updating in a simple three-stage game, where two types of plaintiffs (large stake/low stake) file sequentially a lawsuit against a defendant. In a first stage, the first type decides either to sue individually or to initiate a class action; then, in the second stage, the second type decides either to file an individual suit or to join the class action when it has been previously formed; finally, in the third stage, the defendant makes one "take-it-or-leave-it" offer either to an individual plaintiff or to the representative member of a class action.

In the next paragraph, we introduce the formal model; we consider that two (types of) plaintiffs have been injured by the same individual either through two different individual accidental events occurring in a short period of time, thus implying repeated trials. They are supposed to be heterogenous in their claim of damage awards (or equivalently in the loss they have experienced): plaintiff denoted P_i has low stake θ_i, while plaintiff denoted P_j has a high stake $\theta_j > \theta_i$.

2.2 the sequence of individual decisions

We consider a simple three-stage game, where plaintiffs enter sequentially in the litigation process against the defendant, such that P_i is the first filer. In stage 1, P_i may choose between two options: either he files or he exits. In this last case, everything is over for him, and then, P_j has only to decide for himself whether he enters and files individually, or if he exits. If P_i opts for filing, two institutional choices are available to him: either he can sue individually, or he can decide to initiate a class action, to which every individuals that have suffered a damage may join. In stage 2 beginning after P_i's move, P_j chooses either to sue individually or to register to become a member of the class action.

As it is usual in the literature, we assume that the membership is voluntary and open, such that the presence of a class action does not legally compel other plaintiffs to join it, and no individual plaintiff is denied membership against his wishes. In practice, Courts decide to maintain a class action or not, and prescribe deadlines for claimants' participation or opt out decisions. In the present set up, this reflects the equilibrium behaviors of plaintiffs, in such a way that after a limited period of time during which any individual has the opportunity to opt out of the class action, the membership becomes binding: no class action member can opt out, and no new plaintiff can opt in. Moreover, once a class action is formed, which is requiring that more than one plaintiff register, it sues on behalf of all its members. Here, no difference is made between the case where the representative plaintiff who has initiated the class action litigates for all members, or the case where the active role is played by the class action's attorney. We assume that the delegation of the collective negotiation power to one of the member or to a third party leads to no agency problem and does not require any incentive scheme to monitor the efforts of the class action representative agent, who is supposed always to act in the best interest of all its members.

In stage 3 finally, we consider that pretrial negotiations may also take place, leading to an amicable settlement of claims rather than their litigation at trial. That is, after that a suit (individual or collective) is brought against the defendant, this one has the opportunity to make a take-it-or-leave-it offer to the other party (individual plaintiff or class action). Thus, either the defendant's offer is accepted (by a plaintiff or the class action), and thus the claim is settled, or it is rejected. In this event, we consider that either the claim goes to trial, or the plaintiff gives up.

As for the Court's behavior, it is assumed that the judge awards a compensatory damage equal to the claim of the defendant in case of an individual suit, while he sets the damage obtained by each member of a class action equal to an index of the aggregate merit of the class, which is defined as $\Theta = \alpha\theta_i + (1-\alpha)\theta_j$, with $\alpha \in]0,1[$ being either the proportion of plaintiffs i in the population of filers, or an parameter of the discretion power of judges. The role of this rule of damage averaging is part of the present paper, and the distinction between those possible explanations will be discussed in the last part of the paper.

The individual outcomes also depend on the various litigation expenditures

incurred by the plaintiff, since filing a suit is a costly activity. When filling an individual suit both plaintiffs bear the same litigation costs, which are of two kinds. The first one corresponds to the administrative registration of the claim, $C > 0$, which is supposed to be a sunk cost: whatever his decision, either he maintains his action until it is settled through a negotiation with the defendant or at trial, or he gives up after registration, the plaintiff never recovers this expenditure. The second one, $C_p > 0$, corresponds to litigation costs *per se* such as attorney fees, auditing or expertise costs and so on, that are borne only when the plaintiff files, to produce evidences in order to strengthen the Court's beliefs that the defendant is liable. In contrast, joining a class action allows plaintiffs to litigate for smaller individual costs, $K_p > 0$. Moreover, members of the class action incur an additional sunk cost $K > 0$ (corresponding to registration costs and various administrative costs). We assume that:

ASSUMPTION 1: $\theta_j > \theta_i > C_p$

ASSUMPTION 2: $0 < K_p < C_p$, and $0 < K < K_p$

which means that if a plaintiff were aware of the defendant's liability, he would be prone to sue individually. Notice that the conditions in (2) put on the various transaction costs simply insures that a class action entails scales economies on the various litigation costs: $C + C_p > K + K_p$. Scales economies achieved through the pooling of attorney's services and the decrease in the number of plaintiff's individual appearances in front of the Court, are a classical motive to explain the great appeal of class actions.

The present terminology and definition of the nature of both kinds of costs are introduced for ease of exposition. The clue of the story is coming from the distinction between an entry cost which is paid in order that the plaintiff have an access to the litigation process, on the one hand, and a cost paid only when the plaintiff continues his suit until the end at trial, on the second. Notice that a more sensible interpretation would consider that C as K correspond both to administrative costs *per se* coming from the registration of the claim in from of the Court plus the various sunk costs associated to the use of attorney's counsels (fixed costs such as filing costs, including expertise expenditures) during the pretrial period, whereas C_p as K_p would include more strictly only the expenditures incurred by the plaintiff when his case goes to trial, for instance those corresponding to the "*frais de représentation et de plaidoirie*".

2.3 the discovery process and individual information

In our set up where the plaintiffs enter sequentially in the litigation process, a specific timing of information arrival is required, which may be stylized as follows:
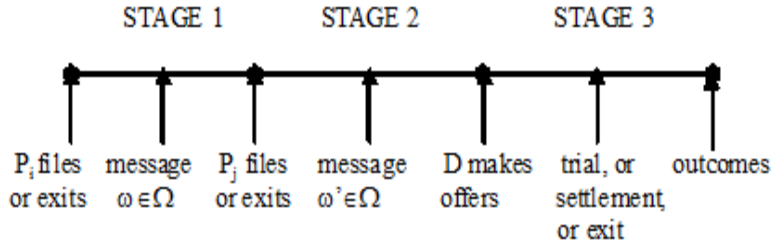
FIGURE 1: the timing of information and decisions

We consider circumstances where all the information which may be obtained (the set of all possible messages) by P_j is the same as what is available for the former P_i. Thus, everything goes as if the messages successively obtained by the litigants were initially drowned in the same set of messages[1]. But, basically, although both plaintiffs have access to the same technology of information, they have not the ability to update their initial beliefs using the same information: plaintiff P_i enters first and only observes his own message, while plaintiff P_j observe a combination of two messages, consisting in his own message and plaintiff $P_i's$ personal message.

Formally, let us denote Ω the set of all available messages providing some piece of evidence with respect to the liability or guiltiness of the defendant. When the P_i (respectively P_j) pays the litigation costs, he receives a message ω (respectively ω') randomly picked in Ω, which will be used to improve his assessment of the likelihood that the defendant will be found liable/not liable at trial.

Since we consider the case of an aggregate technology of information, let us take as a primitive the joint probability distribution[2] $P : S \times \Omega \times \Omega \to [0,1]$, where $S = \{L, NL\}$ is the set of relevant states of the nature regarding the status of the defendant (Liable, Non liable) such that $p(L, \omega, \omega') \geq 0$ is the likelihood that the defendant is liable and the messages obtained respectively by plaintiffs i and j are (ω, ω'), while $p(NL, \omega, \omega') \geq 0$ is the likelihood that the defendant is non liable and the messages obtained respectively by P_i and P_j are (ω, ω').

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[1] Thus, under some circumstances, plaintiff j may receive exactly the same message as plaintiff i: the weight of evidence or the significance of the message is increased in such a case.

[2] See Hirschleifer and Riley (1997), Laffont (2000) for the basic case of an unidimensional technology of information. The specification in terms of joint probabilities is not the more natural or intuitive way to modelize the technology of information, but it is the more general! Anyway, any service of messages reveals the existence of such a joint probability distribution. Here, we are more interested with the benefits associated to the process of beliefs updating allowed by this technology, than on the distortions coming from difference between pure individual subjective priors.

2.4 beliefs updating rules

It is well known that the primitives allow to assess the various probabilities which are relevant in order to describe the informational status of plaintiffs, at each stage of the litigation process. Specifically, our general assumption implies that individuals have common priors, but that beliefs updating allows them to have different posteriors.

First, the primitives are connected to the plaintiffs' common priors on the defendant's liability in a simple way:

$$p_L = \sum_{(\omega,\omega')\in\Omega^2} p(L,\omega,\omega')$$

$$p_{NL} = \sum_{(\omega,\omega')\in\Omega^2} p(NL,\omega,\omega')$$

Using the available technology of information, the plaintiffs are also allowed to assess their chances to obtain additional information. For example:

$$p^i(\omega) = \sum_{\omega'\in\Omega} p(L,\omega,\omega') + \sum_{\omega'\in\Omega} p(NL,\omega,\omega')$$

represents P_i's individual priors to obtain an individual message, when the message obtained by the other plaintiff is not observable. In our set up, where P_j files after P_i, we are interested by the case where P_j has the opportunity to observe also the message previously obtained by i; hence, the probability of such an event according to the technology of information at hand is:

$$p^j(\omega,\omega') = p(L,\omega,\omega') + p_{NL}(\omega,\omega')$$

As a consequence, P_j will update his beliefs according to the rule:

$$(R1) : p^j(L|\omega,\omega') = \frac{p(L,\omega,\omega')}{p(L,\omega,\omega') + p(NL,\omega,\omega')}$$

when he observes both his own message and the message of the other plaintiff, but P_i can only condition his revision of beliefs on a unique message according to the rule:

$$(R2) : p^i(L|\omega) = \frac{\sum_{\omega'\in\Omega} p(L,\omega,\omega')}{\sum_{\omega'\in\Omega} p(L,\omega,\omega') + \sum_{\omega'\in\Omega} p(NL,\omega,\omega')}$$

with:

$$p(L,w) = \sum_{\omega'\in\Omega} p(L,\omega,\omega')$$

In this context, the possible evidences that may be gathered during the discovery process does not change after that P_i eventually files and before P_j decides to enter. Nevertheless, P_j may benefit of the message obtained by P_i

(he benefits of the efforts undertaken by the former in the discovery process). Thus, he may update his likelihood of success according to both messages.[3]

3   Equilibrium Analysis

We first introduce as a benchmark model the case of a system allowing only individual suits: thus two repeated trials occur. Then, we introduce the possibility of a class action, plaintiff having the opportunity either to sue individually of to register a class action.

3.1   precedents, repeated trials and pure individual suits

When repeated trials occur (P_i's case is first settled), the last filer may benefit of the existence of jurisprudence or precedents as a result of a pure informational effect. We investigate how this involuntary sharing of information between plaintiffs affects the individual incentives to file.

Hence, assume that the class action is not allowed as a litigation option: plaintiffs can file only an individual suit. Players' moves in stage 3 are the following: for the defendant, make an individual offer for each plaintiff; and each individual plaintiff may choose between: go to trial T; exit E; settle S). Let us denote $s(\theta_i, \omega)$ and $s(\theta_j, \omega, \omega')$ the settlement offer made by the defendant respectively to P_i and P_j, since it depends on the case and the information obtained.

When a case is litigated, any information which is revealed is always shared between the plaintiff and the defendant. In the present set up, the defendant always exercise his rights to the discovery process, since it allows him either to settle for an offer lesser than when the plaintiff is silent, and/or to litigate while saving the trial costs. The following lemma first solves for the efficient decision of the defender and the response of the plaintiffs when the last stage of the game is seen as a "one-shot" bargaining process, exhibited in figure 2:

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[3]In some circumstances however, P_j may gather an additional information, which is whether the evidence that should have been by the previous plaintiff (even when he only obtained partial information) is or not always available or true. In words, some events previously unbelievable are now available as pieces of evidence, and more specifically are seen as acceptable by Courts (unforseen contingencies). This case will be investigate in a compagon paper.
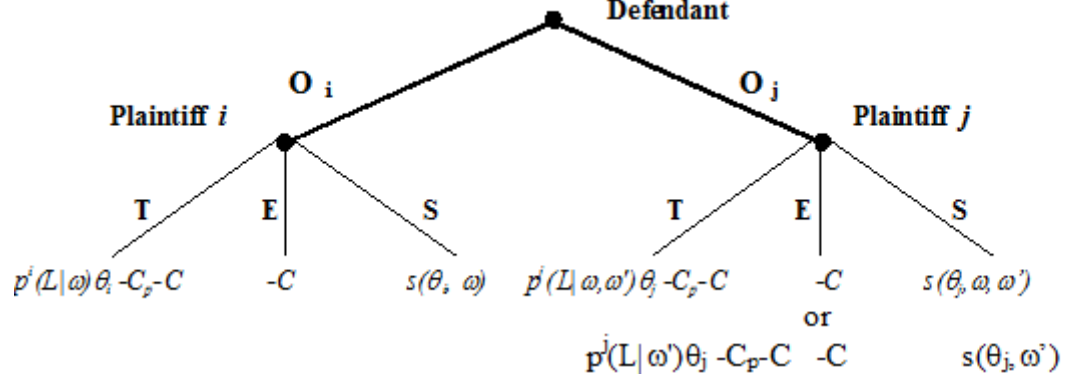
FIGURE 2 : stage 3 in the pure individual suits game

Lemma 1 *Consider plaintiffs and defendant's moves in stage 3:*

i) For any message $\omega \in \Omega$, corresponding to the information obtained by P_i, the best "one shot" individual offer made by the defendant to plaintiff P_i is: $s(\theta_i, \omega) = \max\left(0, p^i(L|\omega)\theta_i - C_p\right)$. P_i accepts this offer[4].

ii) For any combination of messages $(\omega, \omega') \in \Omega \times \Omega$, corresponding to the information obtained by P_j, the best "one shot" individual offer made by the defendant to plaintiff P_j is $s(\theta_j, \omega, \omega') = \max(0, p^j(L|\omega, \omega')\theta_j - C_p)$. P_j accepts this offer.

The proof and those of all lemmas and propositions of the paper are afforded in the appendix.

Coming back to stage 2, P_j evaluates his own opportunity to file or not without the knowledge of the relevant message that will be available in the future, but only knowing the set of possible messages afforded by the available technology of information. Let us denote his expected utility level given the various possible messages that he may receive as follows:

$$Eu_j(\theta_j, p^j(L|.,.)) = \sum_{(\omega,\omega')\in\Omega^2} p^j(\omega, \omega') \max\left(0, p^j(L|\omega, \omega')\theta_j - C_p\right) - C$$

and given the priors, let us denote his expected utility level as:

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[4] As far as Subgame Perfection is concerned, we should also consider the case where the plaintiff goes to trial, thus allowing for multiplicity of equilibria; however for concretness, we adopt in the rest of the paper the convention that the indifference between trial and seetlement amounts to a strict preference for the settlement. See the discussion in Rasmusen (2001), Shavell (1989).

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$$Eu_j(\theta_j, p_L) = p_L\theta_j - C_p - C$$

The following lemma analyses when plaintiff P_j sues or gives up.

Lemma 2 *i) Assume that only "good news" are expected to arrive; then, information is not worth for P_j i.e.:*

$$\text{if } min\left\{p^j(L|\omega, \omega'), \text{ for all } (\omega, \omega') \in \Omega \times \Omega\right\} \geq \frac{C_p}{\theta_j}, \text{ then:}$$

$$Eu_j(\theta_j, p^j(L|.,.)) = p_L\theta_j - C_p - C$$

ii) Assume that there exists a unique combination of messages $(\hat{\omega}, \hat{\omega}') \in \Omega \times \Omega$ such that $p(L, \hat{\omega}, \hat{\omega}') \geq \frac{C_p}{\theta_j}$; then, information is worth for P_j, i.e. : $Eu_j(\theta_j, p^j(L|.,.)) - Eu_j(\theta_j, p_L) \geq 0$.

iii) Assume that there exists at least one combination of messages $(\hat{\omega}, \hat{\omega}') \in \Omega \times \Omega$ such that $p(L, \hat{\omega}, \hat{\omega}') \geq \frac{C_p + C}{\theta_j}$; then P_j always files individually, i.e. $Eu_j(\theta_j, p^j(L|.,.)) \geq 0$.

Part i) implies that if priors are "optimistic" for P_j, then P_j always files, i.e. $p_L \geq \frac{C_p + C}{\theta_j} \implies Eu_j(\theta_j, p^j(L|.,.)) \geq 0$, but if $p_L < \frac{C_p + C}{\theta_j}$ then the plaintiff gives up $(Eu_j(\theta_j, p^j(L|.,.)) < 0)$.

Part ii) means that if priors are "pessimistic" for P_j, then P_j may nevertheless file, i.e. we may have $Eu_j(\theta_j, p^j(L|.,.)) \geq 0$ although $p_L \leq \frac{C_p + C}{\theta_j}$.

Part iii) means that once there exists a very good news, the plaintiff always prefer to file an individual suit.

The same qualitative results also apply to P_i: in stage 1, he evaluates the opportunity to file or not without the knowledge of the relevant message that will be available in the future, but only knowing the set of possible messages afforded by the available technology of information. Let us define by:

$$Eu_i(\theta_i, p^i(L|.)) = \sum_{\omega \in \Omega} p^i(\omega) \max\left(0, p^i(L|\omega)\theta_i - C_p\right) - C$$

his expected utility level associated to the technology of information, and:

$$Eu_i(\theta_i, p_L) = p_L\theta_i - C_p - C$$

his satisfaction level associated to his priors, which are the same as the other plaintiff. Thus, we have:

Lemma 3 *i) Assume that only "good news" are expected to arrive; then, information is not worth for P_i, i.e.:*

$$if\ min\left\{p^i(L|\omega),\ for\ all\ \omega \in \Omega\right\} \geq \frac{C_p}{\theta_i},\ then:$$
$$Eu_i(\theta_i, p^i(L|.)) = p_L\theta_i - C_p - C$$

ii) Assume that there exists a unique message $\hat{\omega} \in \Omega$ such that $p(L, \hat{\omega}) \geq \frac{C_p}{\theta_i}$; then, information is worth for P_i, i.e.: $Eu_i(\theta_i, p^i(L|.)) - Eu_i(\theta_i, p_L) \geq 0$.

iii) Assume that there exists at least one message $\hat{\omega} \in \Omega$ such that $p(L, \hat{\omega}) \geq \frac{C_p+C}{\theta_i}$; then P_i always files individually, i.e. $Eu_i(\theta_i, p^i(L|.)) \geq 0$.

Saying differently, lemma 2 and 3 display the conditions under which a plaintiff obtains an informational rent as a result of the discovery process. Information has a positive value in the present context only when litigants know that bad news sometimes may be obtained. With additional information, a plaintiff updates his priors, and he is allowed to undertake the best possible decision in every circumstances, given that he can exercise an exit option if the information learned appears to be unfavorable for his case.

In this sense, introducing arrival of new information and updating of beliefs may explain that holders of nuisance suits or pessimistic victims (conditionally on their priors: *i.e.* $p_L\theta - C_p - C < 0$) have an incentive to file, in the hope to learn good news in the future and pursue until trial their action. In this last case, it depends on stronger conditions on the technology of information.

This is highlighted in parts iii) of the lemmas. Each of Parts iii gives a simple sufficient condition required whatever the priors (optimistic or pessimistic) in order to induce a plaintiff to file an individual lawsuit, saying that the plaintiff knows that there exists at least a very favorable message entailing a large probability that the defendant will be seen liable by the Court. This last result may be understood as saying that it is of no use that a plaintiff expect to always receive a favorable message in the future, to induce him to file a suit: it is sufficient that there exists a single favorable message, given that in others circumstances, he will be induced to give up having only paid the administrative sunk costs.

In contrast, Part i of both lemmas shows interestingly enough that when the available (technology of) information does not allow the possibility of bad events or news, such that the plaintiffs expect to obtain a positive payment from the defendant in any future event, then the discovery process provides no additional value in the sense that whether plaintiffs update their priors depending on the new message collected or use their priors, in both cases they undertake the same efficient decision.

Lemmas 1 to 3 lead to the following proposition:

Proposition 4 *Assume that there exists at least one combination of messages $(\hat{\omega}, \hat{\omega}') \in \Omega \times \Omega$ such that $p(L, \hat{\omega}, \hat{\omega}') \geq \frac{C_p + C}{\theta_i}$; then there exists a Subgame Perfect Equilibrium where i) each plaintiff file individually, and ii) both cases are settled.*

Remark that the requirement that there exists a $p(L, \hat{\omega}, \hat{\omega}') \geq \frac{C_p + C}{\theta_i}$ also implies that $p(L, \hat{\omega}, \hat{\omega}') \geq \frac{C_p + C}{\theta_j}$, meaning that any information delivered by the technology which appears as favorable for P_i is also good for P_j. As it is easily seen, this is a weak requirement in the sense that it is sufficient that plaintiffs are aware of the fact that there is one chance to obtain at least a good information, to induce them to file a suit. There is no need to be sure that good news always arrive in the future.

The next corollary is a straightforward consequence of the previous lemmas:

Corollary 5 *If information has a positive value:*

i) Any information favourable to the defendant (respectively, to the plaintiffs) reduces (increases) the settlement offer, as compared to the case where no no additional information arrives.

ii) The probability of settlement is smaller than one.

Consider the case of the first plaintiff - the argument is the same in the other case. A favourable information for the defendant corresponds to a message such that $p_L > p^i(L|\omega)$ which implies $p_L \theta_i - C_p > p^i(L|\omega)\theta_i - C_p$. Now, in the case where information is worth, there is only a subset $\Lambda_i \subset \Omega$ of possible messages for the first plaintiff such that $p^i(L|\omega)\theta_i - C_p > 0$, $\forall \omega \in \Lambda_i$: then, the probability of settlement corresponds to the cumulative probability that the plaintiff obtains these favourable messages $\sum_{\omega \in \Lambda_i} p(\omega) < 1$.

3.2   information sharing and the large class action

Consider now that class actions are available. Let us focus more specifically on the proper subgame beginning after P_j decides to adhere to the class action. In stage 3, the defender makes an offer to the class action members, such that when the information pooled by the members of the class action corresponds to the messages (ω, ω'), the settlement benefit of each member of the class action is $s(\Theta, \omega, \omega')$.
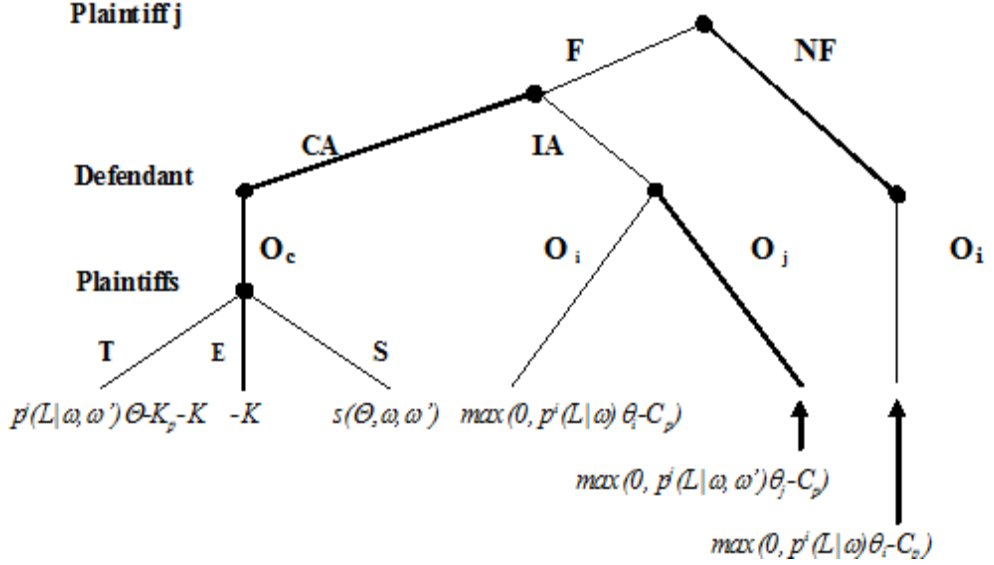
16

FIGURE 3 : stage 3 in the class action game

Lemma 6 *Consider the decision node in stage 3 where the defendant is facing a class action. For any combination of messages $(\omega, \omega') \in \Omega \times \Omega$, the best "one shot" individual offer made by the defendant to the class action is: $s(\Theta, \omega, \omega') = \max\left(0, p^j(L|\omega, \omega')\Theta - K_p\right)$. The class action members accept this offer.*

This implies that the defendant makes a positive offer to the class action soon as $p^j(L|\omega, \omega') > \frac{K_p}{\Theta}$. On the other hand, in any proper subgame in stage 3 beginning after that P_i gives up to initiate a class action, or after that P_i gives up to join it, the best individual offers of the defendant are those of lemma 1 (see also figure 3 where these subgames have been replaced by the defendant's best offer).

We can now analyze the efficient decisions of P_j, considering separately the decision to join or not the class action (decision node following the entry of P_j), and finally the decision to file or not (decision node initiating the subgame of figure 3). P_j's efficient decisions in stage 2 may be as follows:

Lemma 7 *Assume that there exists a subset[5] of combinations of messages $\Lambda_j \subset$*

---

[5] It is easy to see that this subset would be a singleton, *i.e.* the weakest sufficient condition required to have the same result of the lemma may be stated as follows: Assume that there exists at least one combination of messages $(\hat{\omega}, \hat{\omega}') \in \Lambda_j : p(L, \hat{\omega}, \hat{\omega}') \geq \frac{C_p + C}{\theta_j}$, and assume that $\alpha \leq \frac{C_p - K_p}{p^j(L|\hat{\omega}, \hat{\omega}')(\theta_j - \theta_i)}$.

Ω^2 such that for any $(\omega, \omega') \in \Lambda_j : p(L, \omega, \omega') \geq \frac{C_p + C}{\theta_j}$, and assume that $\alpha \leq \alpha^* \equiv \frac{C_p - K_p}{\pi^*(\theta_j - \theta_i)}$ where $\pi^* = \max \left\{ p^j(L|\omega, \omega'), \text{ for all } (\omega, \omega') \in \Lambda_j \right\}$. Then, i) P_j always files in the second stage, and ii) he prefers to join the class action when it has been initiated by P_i rather than to sue individually.

The following lemma focuses on the decision of the first plaintiff.

Lemma 8 *Assume that there exists a subset of messages $\Lambda_i \subset \Omega$, such that for any $\omega \in \Lambda_i : p^i(L, \omega) \geq \frac{C_p + C}{\theta_i}$. Thus, P_i always files in the first stage, and he prefers to initiate the class action rather than to sue individually.*

Using the material of lemmas 6 to 8, we have:

Proposition 9 *Assume that: (C1) there exists a unique combination of messages $(\omega, \omega') \in \Omega^2$ such that $p(L, \hat{\omega}, \hat{\omega}') \geq \frac{C_p + C}{\theta_i}$, and (C2): $\alpha \leq \hat{\alpha} \equiv \frac{C_p - K_p}{p^j(L|\hat{\omega}, \hat{\omega}')(\theta_j - \theta_i)}$. Then, there exists a SPE where i) the class action is formed, and ii) the aggregate case is settled.*

Proposition 9 displays a set of sufficient conditions in order that the large class action (encompassing both types of individuals) exists in equilibrium.

The result of proposition 9 is a direct consequence both of our specification of the technology of information, and of the assumption that the discovery process is perfect in the sense that there is a perfect mutualization of the information between plaintiffs and the defendant. In such a case, the two crucial issues are 1/ whether the first plaintiff prefers the structure of information defined by the set of his own personal messages, or the structure associated to the combination of two messages, his personal one and the information of the other plaintiff; 2/ whether the second one obtains a higher payments when he becomes a member of the class action or not.

In the present context, P_j observes his own message and the first plaintiff's one whether or not he joins the class action; thus, he preferres to join the class action as long as the decrease in the litigation costs associated to the collective action $(K_p < C_p)$ is not fully compensated by the decrease in the expected payment awarded at trial given that the Court uses an index of the aggregate claim in case of a class action $(\Theta < \theta_j)$: (C2) corresponds to the requirement needed to insure the participation of P_j : it must be that the proportion of large stakes in population of plaintiff is high enough.

The result may be easily generalized, as in lemma 6, to introduce several messages being good news for plaintiffs in the sense of (C1). Nevertheless, consider the case where there is only a single combination $(\hat{\omega}, \hat{\omega}')$ satisfying (C1); then, the threshold $\hat{\alpha}$ may work as follows:

CASE 1: $p^j(L|\hat{\omega}, \hat{\omega}')\theta_i - K_p > p^j(L|\hat{\omega}, \hat{\omega}')\theta_j - C_p \Longrightarrow \hat{\alpha} > 1$

The inequality means that up to sunk costs, the expected outcome at trial of P_i when the class action is formed is larger than the expected outcome of P_j for an individual suit, given the nature of the information obtained by plaintiff (given $p^j(L|\hat{\omega}, \hat{\omega}')$). Then, any value of $\alpha > 0$ satisfies condition (C2), which is thus irrelevant in proposition 9. This is because in such a case, we also have:

$$p^j(L|\hat{\omega}, \hat{\omega}')\Theta - K_p > p^j(L|\hat{\omega}, \hat{\omega}')\theta_i - K_p > p^j(L|\hat{\omega}, \hat{\omega}')\theta_j - C_p$$

which insures that P_j always prefers to register the class action.

CASE 2: $p^j(L|\hat{\omega}, \hat{\omega}')\theta_i - K_p < p^j(L|\hat{\omega}, \hat{\omega}')\theta_j - C_p \Longrightarrow \hat{\alpha} < 1$

As a result, the constraint on the proportion of small losses applies, with the threshold depending as follows on the parameters of the economy:

	$C_p - K_p$	$\theta_j - \theta_i$	$p^j(L|\hat{\omega}, \hat{\omega}')$
$\hat{\alpha}$	+	−	−

On the other hand, the basic reason explaining why the first plaintiff initiates the class action, is that when the discovery process is perfect, the posteriors distribution $p^j(L|.,.)$ is *more informative* in the sense of Blackwell (1953) than the posteriors distribution $p^j(L|.)$: for any message $\omega \in \Omega$, there always exists at least one message $\omega' \in \Omega$ such that: $p^j(L|\omega, \omega') > p^i(L|\omega)$ and one message $\omega'' \in \Omega$ such that: $p^j(L|\omega, \omega'') < p^i(L|\omega)$. Thus, the posterior beliefs $p^i(L|.)$ provides the plaintiff with some information which has been "garbled" in the transmission as compared to the priors $p^j(L|.,.)$. Anything goes as if the information associated to $p^j(L|.,.)$ were sent, but it has been received by P_i with some additional noise, such that finally P_i recognized only the information attached to $p^i(L|.)$.

4 Extensions: damage averaging, conditional and contingent fees

It is straightforward to verify that when plaintiffs having large stake become the first filers, nothing more is added to the results, since the class action is formed under the same conditions as those in proposition 9. Thus, as far as the discovery process is perfect, the choice of the order of plaintiffs' entry introduce no strategic aspect. In contrast, alternative specifications of costs or compensation rules applied by Court may have more serious consequences.

In this section, we first consider the impact of alternative rules of damage awarded by Courts, and specifically, the role of "damage averaging". Finally, we introduce alternative schemes for attorney' fees and investigate their influence on the formation of a class action in the present set up.

4.1 Courts' behavior and the damage averaging rule

The rule of damage award set by Courts is of major importance in context where the entry of different plaintiffs entail a strategic aspect as it is the case enhanced by Mongrain and Marceau (2003), since it induces both the composition of the class action and the identity/type of the plaintiff who initiates the class action. Interestingly enough this also occurs in our set up: we may suggest another interpretation of condition (C2) in proposition 8, which is a central condition for the occurrence of the class action to the extent that it monitors the behavior of large stakes holders.

Assume that Courts award a compensation to each member of a class action which is defined as the weighted sum of his personal claim and the aggregate value of the class action; formally: $d_s = \gamma\Theta + (1-\gamma)\theta_s$, with $\gamma \in [0,1]$, for any P_s ($s = i, j$). In the following, γ will be termed the *degree of damage averaging*. When $\gamma = 1$, Courts award the aggregate merits of the class action to each member, while when $\gamma = 0$, the Courts award only individual damages. Straightforward manipulations show that:

$$d_i = (1 - \gamma(1-\alpha))\theta_i + \gamma(1-\alpha)\theta_j$$
$$d_j = \alpha\gamma\theta_i + (1 - \alpha\gamma)\theta_j$$

As a result, the following result applies:

Proposition 10 *Assume (C1); then, there always exists a degree of damage averaging such that the large class action occurs in equilibrium, i.e. there exists a threshold degree of damage averaging namely:* $\gamma^* \equiv \frac{C_p - K_p}{p^j(L|\hat{\omega},\hat{\omega}')\alpha(\theta_j - \theta_i)}$, *such that for any $\gamma \leq \gamma^*$ the large class action is formed at equilibrium.*

Once more, it is easy to see that soon as[6] $p^j(L|\hat{\omega},\hat{\omega}')\theta_i - K_p > p^j(L|\hat{\omega},\hat{\omega}')\theta_j - C_p$ holds, which implies that $\frac{C_p - K_p}{p^j(L|\hat{\omega},\hat{\omega}')(\theta_j - \theta_i)} > 1$, then all else equal the existence of a class action is compatible with any (positive) value of the level of damage averaging - or equivalently, the rule set by the Court is of no matter. In the opposite case, however, the Court has the opportunity to favor (or not) the formation of the class action, whatever the structure of the population of plaintiffs. Allowing a large degree of damage averaging, and plaintiff having large stake are deter from participating to the class action when it has been initiated, since the decrease in litigation costs does not compensate the loss in terms of compensatory damage. Thus, it is a matter of precaution when Courts set compensatory damages to members of a class action as close as possible to their individual claims.

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[6] This condition has a nice interpretation, saying that the expected payment obtained by a small loss holder when Court applies full individual damages to any member of a class action, is higher than the expected payment to a large stake holder suing individually.

4.2 conditional and contingent fees

One way to understand the results of the previous section is the following: for plaintiffs, the opportunity to obtain additional information may work as a credible threat in order to obtain recovery from the defendant, although they have pessimistic beliefs before trial. It is more usual in the literature to consider that litigation costs, specifically attorneys' fees, may be used strategically, playing the role of a device which commits plaintiffs having pessimistic priors (holding nuisance suits) to file and sue until trial[7].

In the case of class actions, specific attention has been paid to contingent fees (Klement and Neeman (2004), Lynk (1990,1994), Miceli and Segerson (1991)), or to conditional fees (Emons (2004a,b), Emons and Garoupa (2004)). The rational for the use of contingent or conditional fees to pay for attorney's services is twofold. The first advantage of contingent fees is that they induce the absence of risk of filling a lawsuit for plaintiffs, since the risk is borne by the attorney: plaintiffs owe their attorney a fee only when there is recovery, *i.e.* when they win at trial. The other advantage is that they enable plaintiffs to monitor the effort undertaken by attorney for the time they spend to their clients' case, and give them efficient incentives to maximize their client's recovery.

When *conditional fees* are introduced, a plaintiff pays the amount corresponding to his attorney's services only in the case where he wins at trial. Hence, the expected payment at trial is equal to the probability to win (given the relevant information.) times his damage award minus attorney's fees:

$$
\begin{array}{rcl}
p^i(L|\omega)(\theta_i - C_p) & : & for\ P_i \\
p^j(L|\omega, \omega')(\theta_j - C_p) & : & for\ P_j \\
p^j(L|\omega, \omega')(\Theta - K_p) & : & for\ a\ CA
\end{array}
$$

The following proposition[8] shows that in such case, information has no role to play here, in the sense that the arrival of new information during the litigation process does not change plaintiff's decision as compared to the decisions which would be undertaken with no additional information over the information conveyed by the priors.

---

[7] See Rasmusen (2001) for an example; once a plaintiff sinks his litigation costs, he is commited to sue as far as he has any chance of success at all - in contrast, he gives up soon as he is handled with a totally meritless suit.

[8] When *contingent fees* are used, a plaintiff pays an amount corresponding to a fixed percentage of the value of the claim only in case of recovery, *i.e.* the costs corresponding to the payment of attorneys' services is proportional to the expected value of the claim; in such a case, the value of the expected outcome at trial is a given percentage of the claim:.

$$
\begin{array}{rcl}
p^i(L|\omega)(1-t)\theta_i & : & for\ P_i \\
p^j(L|\omega, \omega')(1-t)\theta_j & : & for\ P_j \\
p^j(L|\omega, \omega')(1-\tau)\Theta & : & for\ a\ CA
\end{array}
$$

with t (respectively τ) $\in]0,1[$ being the percentage of the value of the claim in case of an individual action (collective action) charged by the attorney, and $t > \tau$.

Proposition 11 *Under both contingent and conditional fees:*
i) Parties always settle.
ii) The value of information is null for both plaintiffs.
iii)
iii) the settlement offers are larger than undezr the fixed costs rule

Proposition 11 shows that plaintiffs become neutral to the arrival of news when contingent fees are used, such that the decision to file depends only on their initial belief of the outcome at trial. This suggests that if contingent fees may solve agency problems between plaintiffs and their counsel, on the other hand they may entail pervasive effects such as making victims not enough careful with the arrival of new information.

The intuition is the following. Consider a plaintiff with an initial belief on his case, who wants to verify the quality of his claim at trial: he may use a simple "test" corresponding to buying the services of a lawyer; this last one will inform the plaintiff whether he has a high probability to win at trial or a law one, and when alternative litigation strategies may be used at trial, contingent fees monitors attorney's efforts to choose the strategy leading to maximal recovery for plaintiff. Proposition 11 tells us that this test is of no value for the plaintiff: his initial decision to enter or not depends only on his prior beliefs on his case, when contigent fees are used, since in case of an individual suit for example we have: $Eu_i(\theta_i, p^i(L|.)) = Eu_i(\theta_i, p_L)$ and $Eu_j(\theta_j, p^j(L|.,.)) = Eu_j(\theta_j, p_L)$.

Finally, this characteristic of contingent fees allows us to consider directly the issue of the deterrence effects of plaintiffs:

Proposition 12 *Consider that a class action always exists, whatever the rule of costs at hand. As compared to the case with fixed litigations costs, under conditional fees[9]:*
i) there is more deterrence effects on the small claims when the sunk costs K are large enough, and;
ii) there is also more deterrence effects on the large claims.

5   Conclusion

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[9] The equivalent result under contingent fees (available on request) is: there is more deterrence effects on the small claims; and: there is also more deterrence effects on the large claims when the savings on attorneys' services $C_p - K_p$ are large enough.

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APPENDIX

Proof of lemma 1:

Given that the administrative cost C is sunk, it is easy to see that when P_j obtains the message ω' after that P_i has received message ω, the defendant chooses a "take-it-or-leave-it" offer in order to render the plaintiff indifferent between going to trial (suing) or accepting the offer: hence $s(\theta_j, \omega, \omega') = \max\big(0, p^j(L|\omega, \omega')\theta_j - C_p\big)$, where $p^j(L|\omega, \omega')$ follows R1. Symmetrically, when he faces the message ω with P_i, the defendant makes a "take-it-ot-leave-it" offer in order to render the plaintiff indifferent between going to trial (suing) or accepting the offer: hence $s(\theta_i, \omega) = \max\big(0, p^i(L|\omega)\theta_i - C_p\big)$, where $p^i(L|\omega)$ follows R2. Hence the result. ∎

Proof of lemma 2:

i) Consider that $\min\big\{p^j(L|\omega, \omega'), \forall(\omega, \omega') \in \Omega \times \Omega\big\} \geq \frac{C_p}{\theta_j}$; thus, $\forall(\omega, \omega') \in \Omega \times \Omega$, it comes that $\max\big(0, p^j(L|\omega, \omega')\theta_j - C_p\big) = p^j(L|\omega, \omega')\theta_j - C_p$, such that:

$$
\sum_{(\omega,\omega')\in\Omega^2} p^j(\omega,\omega') \max\big(0, p^j(L|\omega,\omega')\theta_j - C_p\big) - C
$$
$$
= \sum_{(\omega,\omega')\in\Omega^2} p^j(\omega,\omega') \big(p^j(L|\omega,\omega')\theta_j - C_p\big) - C
$$
$$
= p_L\theta_j - C_p - C
$$

given that, by construction of the technology of information, we have both:

$$
\sum_{(\omega,\omega')\in\Omega^2} p^j(\omega,\omega') = 1,
$$
$$
\sum_{(\omega,\omega')\in\Omega^2} p^j(\omega,\omega')p^j(L|\omega,\omega') = \sum_{(\omega,\omega')\in\Omega^2} p(L,\omega,\omega') = p_L
$$

Hence the result.

ii) More generally, given that $\forall(\omega, \omega') \in \Omega \times \Omega : \max\big(0, p^j(L|\omega, \omega')\theta_j - C_p\big) \geq p^j(L|\omega, \omega')\theta_j - C_p$, we have after multiplying both terms of this inequality by $p^j(\omega, \omega')$ and then summing over all the possible messages:

$$
\sum_{(\omega,\omega')\in\Omega^2} p^j(\omega,\omega') \max\big(0, p^j(L|\omega,\omega')\theta_j - C_p\big) - C
$$
$$
\geq \sum_{(\omega,\omega')\in\Omega^2} p^j(\omega,\omega') \big(p^j(L|\omega,\omega')\theta_j - C_p\big) - C
$$
$$
= p_L\theta_j - C_p - C
$$

Hence $Eu_j(\theta_j, p^j(L|.,.)) \geq Eu_j(\theta_j, p_L)$, which is by definition the value of the information afforded by the available technology of messages. Thus, assuming a unique combination $(\omega, \omega') \in \Omega \times \Omega$: such that $\max\left(0, p^j(L|\omega, \omega')\theta_j - C_p\right) = p^j(L|\omega, \omega')\theta_j - C_p$, the result is direct.

iii) Let us assume that there exists at least one combination of messages $(\hat{\omega}, \hat{\omega}') \in \Omega \times \Omega$ such that $p(L, \hat{\omega}, \hat{\omega}') \geq \frac{C_p + C}{\theta_j}$; remark that this implies:

$$p^j(L|\hat{\omega}, \hat{\omega}') = \frac{p(L, \hat{\omega}, \hat{\omega}')}{p^j(\hat{\omega}, \hat{\omega}')} \geq \frac{C_p}{p^j(\hat{\omega}, \hat{\omega}')\theta_j} \geq \frac{C_p}{\theta_j}$$

As a result, it comes that:

$$
\begin{aligned}
Eu_j(\theta_j, p^j(L|.,.)) &= p^j(\hat{\omega}, \hat{\omega}')\left(p^j(L|\hat{\omega}, \hat{\omega}')\theta_j - C_p\right) \\
&\quad + \sum_{(\omega, \omega') \neq (\hat{\omega}, \hat{\omega}')} p^j(\omega, \omega')\max\left(0, p^j(L|\omega, \omega')\theta_j - C_p\right) - C \\
&\geq p(L, \hat{\omega}, \hat{\omega}')\theta_j - p^j(\hat{\omega}, \hat{\omega}')C_p - C \\
&\geq p(L, \hat{\omega}, \hat{\omega}')\theta_j - C_p - C
\end{aligned}
$$

since by construction $\sum_{(\omega, \omega') \neq (\hat{\omega}, \hat{\omega}')} p^j(\omega, \omega')\max\left(0, p^j(L|\omega, \omega')\theta_j - C_p\right) \geq 0$. Now, given that $p(L, \hat{\omega}, \hat{\omega}')\theta_j - C_p - C \geq 0$ by assumption, we obtain $Eu_j(\theta_j, p^j(L|.,.)) \geq 0$. Hence the result. ∎

Proof of lemma 3: omitted (qualitatively the same as in lemma 2).

Proof of proposition 4:
More specifically, we prove the following results:

Claim 13 *Assume that there exists at least one combination of messages $(\hat{\omega}, \hat{\omega}') \in \Omega \times \Omega$ such that $p(L, \hat{\omega}, \hat{\omega}') \geq \frac{C_p + C}{\theta_i}$; then there is a Subgame Perfect Equilibrium which corresponds to the following set of actions:*
1/ Each plaintiff files individually.
2/ The defendant makes two individual offers:

$$
\begin{aligned}
s(\theta_i, \omega) &= \max\left(0, p^i(L|\omega)\theta_i - C_p\right), \forall \omega \in \Omega \text{ for } P_i, \text{ and} \\
s(\theta_j, \omega, \omega') &= \max\left(0, p^j(L|\omega, \omega')\theta_j - C_p\right), \forall (\omega, \omega') \in \Omega \times \Omega \text{ for } P_j
\end{aligned}
$$

3/ Each plaintiff accepts[10] (at each decision node where he has to play) his specific individual offer proposed by the defendant, for every possible information he may receive.

---

[10] Remember that the present model allows for multiplicity of equilibria, since plaintiffs are indifferent in stage 3 between two actions T and S; but this introduces only technical difficulties, and we ignore other SPE.

Proof of claim 13. To prove 1/ it is sufficient to remark that if there exists at least one combination of messages $(\hat{\omega}, \hat{\omega}') \in \Omega \times \Omega$ such that $p(L, \hat{\omega}, \hat{\omega}') \geq \frac{C_p + C}{\theta_i}$, then we also have:

- $p(L, \hat{\omega}, \hat{\omega}') \geq \frac{C_p + C}{\theta_j}$; thus, by part v) of lemma 2, P_j always files, given that he accepts any offer $s(\theta_j, \omega, \omega') = \max\left(0, p^j(L|\hat{\omega}, \hat{\omega}')\theta_j - C_p\right)$,

- $p^i(L, \hat{\omega}) \equiv \sum_{\omega' \in \Omega} p(L, \hat{\omega}, \omega') > p(L, \hat{\omega}, \hat{\omega}') \geq \frac{C_p + C}{\theta_i}$; thus, by part v) of lemma 3, P_i accepts the offer $s(\theta_i, \omega) = \max\left(0, p^i(L|\hat{\omega})\theta_i - C_p\right)$, and he always files. 2/ and 3/ are direct from lemma 1. ∎

Proof of lemma 6: as lemma 1, it is straightforward since K is sunk. ∎

Proof of lemma 7:

Consider the subgame where the defendant offers $s(\theta_j, \omega, \omega')$ to P_j, which is accepted. Remark first that if the subset $\Lambda_j \subset \Omega^2$ exists, for any $(\omega, \omega') \in \Lambda_j$, P_j may obtain a positive payment equal to $\max\left(0, p^j(L|\omega, \omega')\theta_j - C_p\right) = p^j(L|\omega, \omega')\theta_j - C_p \geq 0$. Thus, following the proof of part v) in lemma 2, had he decided to sue individually, $P'_j s$ expected utility level would be positive since:

$$Eu_j(\theta_j, p^j(L|., .)) \geq \sum_{(\omega, \omega') \in \Lambda_j} p(L, \omega, \omega')\theta_j - C_p - C \geq 0$$

given that by construction for any $(\omega, \omega') \in \Lambda_j : p(L, \omega, \omega')\theta_j \geq C_p + C$. Now for any message $(\omega, \omega') \in \Omega \times \Omega$, in order that P_j be better off when he joins the class action rather than to have sued individually, it must be that:

$$p^j(L|\omega, \omega')\Theta - K_p \geq p^j(L|\omega, \omega')\theta_j - C_p$$

which is true as far as $\alpha \leq \frac{C_p - K_p}{p^j(L|\omega, \omega')(\theta_j - \theta_i)}$. Hence assume that $\alpha \leq \alpha^* \equiv \frac{C_p - K_p}{\pi^*(\theta_j - \theta_i)}$ where $\pi^* = \max\left\{p^j(L|\omega, \omega'), \text{ for all } (\omega, \omega') \in \Lambda_j\right\}$; then for any $(\omega, \omega') \in \Lambda_j$:

$$p^j(L|\omega, \omega')\Theta - K_p - K \geq p^j(L|\omega, \omega')\theta_j - C_p - K \geq p^j(L|\omega, \omega')\theta_j - C_p - C$$

Finally, after multiplying both the LHS and the RHS terms of this inequality by $p^j(\omega, \omega')$ and then summing over all the possible messages, we obtain:

$$Eu_j(\Theta, p^j(L|., .)) \geq Eu_j(\theta_j, p^j(L|., .)) \geq 0$$

Hence the result. ∎

Proof of lemma 8:

The crucial issue is whether the first plaintiff prefers the structure of information defined only by the set of his own personal messages, or the structure of information associated to the set of combinations of two messages, his personal ones and the messages of the other plaintiff. We shall show that the second

one is *more informative* in the sense of Blackwell (1953) than the first one; as a result, P_i obtains a higher expected utility with the second one.

To understand this, remark that by (R2) for any message $\omega \in \Omega$ we have:

$$
\begin{aligned}
p^i(L|\omega) &= \sum_{\omega' \in \Omega} \frac{p(L, \omega, \omega')}{\sum_{\omega' \in \Omega} p(L, \omega, \omega') + \sum_{\omega' \in \Omega} p(NL, \omega, \omega')} \\
&= \sum_{\omega' \in \Omega} \left(\frac{p(L, \omega, \omega') + p(NL, \omega, \omega')}{\sum_{\omega' \in \Omega} p(L, \omega, \omega') + \sum_{\omega' \in \Omega} p(NL, \omega, \omega')} \right) \left(\frac{p(L, \omega, \omega')}{p(L, \omega, \omega') + p(NL, \omega, \omega')} \right)
\end{aligned}
$$

which means that the following relationship linking $P_i's$ the two types of posterior beliefs $p^i(L|.)$ and $p^j(L|.,.)$ always applies:

$$
\forall \omega \in \Omega : p^i(L|\omega) = \sum_{\omega' \in \Omega} \beta(\omega, \omega') p^j(L|\omega, \omega') \tag{1}
$$

with $\beta(\omega, \omega') = \frac{p^i(\omega, \omega')}{p^i(\omega)} < 1$ and $\sum_{\omega' \in \Omega} \beta(\omega, \omega') = 1$, meaning that the posteriors $p^j(L|.,.)$ are more spread than the posteriors $p^j(L|.)$, *i.e.* for any message $\omega \in \Omega$, there always exists at least one message $\omega' \in \Omega$ such that: $p^j(L|\omega, \omega') > p^i(L|\omega)$, and there always exists at least one message $\omega'' \in \Omega$ such that: $p^j(L|\omega, \omega'') < p^i(L|\omega)$. By definition, this amounts to say that the posteriors $p^j(L|.,.)$ are more informative than the posteriors $p^j(L|.)$. This is useful in the rest of the proof.

When P_i initiates a class action, and when P_j joins it, information sharing between plaintiffs leads to an expected utility level for the former which is by definition:

$$
Eu_i(\Theta, p^j(L|.,.)) = \sum_{(\omega, \omega') \in \Omega^2} p^i(\omega, \omega') \max \left(0, p^j(L|\omega, \omega')\Theta - K_p \right) - K
$$

with $p^i(L|\omega, \omega') = p^j(L|\omega, \omega'), \forall (\omega, \omega') \in \Omega^2$, whereas if P_i files an individual suit, he obtains:

$$
Eu_i(\theta_i, p^i(L|.)) = \sum_{\omega \in \Omega} p^i(\omega) \max \left(0, p^i(L|\omega)\theta_i - C_p \right) - C
$$

Hence, P_i initiates the class action more particularly soon as:

$$
Eu_i(\Theta, p^j(L|.,.)) \geq Eu_i(\theta_i, p^i(L|.)) \geq 0 \tag{2}
$$

Let us exhibit simple conditions under which the RHS inequality in (2) is true. For that, assume that there exists a subset of message $\Lambda_i \subset \Omega$ such that any $\hat{\omega} \in \Lambda_i$ satisfies: $p^i(L, \hat{\omega}) \geq \frac{C_p + C}{\theta_i}$, which implies that $p^i(L|\hat{\omega}) \geq \frac{C_p}{\theta_i}$; as a consequence, it is easy to see that:

$$
\begin{aligned}
Eu_i(\theta_i, p^i(L|.)) &= \sum_{\hat{\omega} \in \Lambda_i} p^i(\hat{\omega}) \left(p^i(L|\hat{\omega})\theta_i - C_p \right) - C \\
&\geq \sum_{\hat{\omega} \in \Lambda_i} p^i(L, \hat{\omega})\theta_i - C_p - C \\
&\geq 0
\end{aligned}
$$

Remark now that by (1), we have $p^i(L|\hat{\omega})\theta_i - C_p = \sum_{\omega' \in \Omega} \beta(\hat{\omega}, \omega') p^j(L|\hat{\omega}, \omega')\theta_i - C_p$, for any any $\hat{\omega} \in \Lambda_i$, implying thus:

$$
\begin{aligned}
\sum_{\omega' \in \Omega} \beta(\hat{\omega}, \omega') p^j(L|\hat{\omega}, \omega')\theta_i - C_p &\leq \sum_{\omega' \in \Omega} \beta(\hat{\omega}, \omega') \left(p^j(L|\hat{\omega}, \omega')\theta_i - C_p \right) \\
&\leq \sum_{\omega' \in \Omega} \beta(\hat{\omega}, \omega') \max\left(0, p^j(L|\hat{\omega}, \omega')\theta_i - C_p \right)
\end{aligned}
$$

Pre-multiplying by $p^i(\hat{\omega})$, summing over all $\hat{\omega} \in \Lambda_i$, and finally rearranging, we obtain:

$$
\begin{aligned}
\sum_{\hat{\omega} \in \Lambda_i} p^i(\hat{\omega}) \left(p^i(L|\hat{\omega})\theta_i - C_p \right) &\leq \sum_{\hat{\omega} \in \Lambda_i} \sum_{\omega' \in \Omega} p^i(\hat{\omega})\beta(\hat{\omega}, \omega') \max\left(0, p^j(L|\hat{\omega}, \omega')\theta_i - C_p \right) \\
&= \sum_{\hat{\omega} \in \Lambda_i} \sum_{\omega' \in \Omega} p^i(\hat{\omega}, \omega') \max\left(0, p^j(L|\hat{\omega}, \omega')\theta_i - C_p \right) \\
&\leq \sum_{(\omega, \omega') \in \Omega^2} p^i(\omega, \omega') \max\left(0, p^j(L|\omega, \omega')\theta_i - C_p \right) \\
&= Eu_i(\theta_i, p^j(L|.,.))
\end{aligned}
$$

Now, given that $\Theta > \theta_i$ and using assumption 2, it comes that: $Eu_i(\Theta, p^j(L|.,.)) \geq Eu_i(\theta_i, p^j(L|.,.))$. Hence (2) holds, and the lemma 8 is proven. ∎

Proof of proposition 9:
Once more, we prove the following claim:

Claim 14 *Assume that: (C1) there exists a unique combination of messages $(\omega, \omega') \in \Omega^2$ such that $p(L, \hat{\omega}, \hat{\omega}') \geq \frac{C_p + C}{\theta_i}$, and (C2): $\alpha \leq \hat{\alpha} \equiv \frac{C_p - K_p}{p^j(L|\hat{\omega}, \hat{\omega}')(\theta_j - \theta_i)}$. Then, there is a SPE associated to the following set of actions:*
1/ Each plaintiff files.
2/ P_i initiates the class action, and P_j joins it.
3/ The defendant makes three offers:

$$
\begin{aligned}
s(\theta_i, \omega) &= \max\left(0, p^i(L|\omega)\theta_i - C_p \right), \forall \omega \in \Omega \text{ for } P_i \\
s(\theta_j, \omega, \omega') &= \max\left(0, p^j(L|\omega, \omega')\theta_j - C_p \right), \forall (\omega, \omega') \in \Omega \times \Omega \text{ for } P_j \\
s(\Theta, \omega, \omega') &= \max\left(0, p^j(L|\omega, \omega')\Theta - K_p \right), \forall (\omega, \omega') \in \Omega \times \Omega \text{ for a } CA
\end{aligned}
$$

4/ At each decision node in stage 3 where he has to choose an action, each plaintiff accepts the offer (either individually or as a member of the class action) proposed by the defendant[11], for every possible information they may receive.

Proof of claim 14. To prove 1/ and 2/ it is sufficient to remark that if there exists a unique combination of messages $(\hat{\omega}, \hat{\omega}') \in \Omega \times \Omega$ such that $p(L, \hat{\omega}, \hat{\omega}') \geq \frac{C_p + C}{\theta_i}$, then we also have:

- $p^j(L|\hat{\omega}, \hat{\omega}') \geq p(L, \hat{\omega}, \hat{\omega}') \geq \frac{C_p + C}{\theta_j}$; thus, if $\alpha \leq \frac{C_p - K_p}{p^j(L|\hat{\omega}, \hat{\omega}')(\theta_j - \theta_i)}$ by lemma 7, P_j always files and joins the class action initiated by the other plaintiff,

- $p^i(L|\hat{\omega}) \geq p^i(L, \hat{\omega}) \equiv p(L, \hat{\omega}, \hat{\omega}') + \sum_{\omega' \neq \hat{\omega}'} p(L, \hat{\omega}, \omega') > p(L, \hat{\omega}, \hat{\omega}') \geq \frac{C_p + C}{\theta_i}$; thus, by lemma 8, P_i always files and initiated the class action,

Finally, 3/ and 4/ are direct from lemma 5. ∎

Proof of proposition 10:

It is sufficient to prove that, for any message pertaining to the subset $\Lambda_j \subset \Omega^2$ defined in lemma 6, and for any value of α, there always exists a $\gamma \in [0, 1]$ such that:

$$p^j(L|\omega, \omega')d_j - K_p \geq p^j(L|\omega, \omega')\theta_j - C_p$$

with $d_j = \alpha\gamma\theta_i + (1 - \alpha\gamma)\theta_j$, which is equivalent to:

$$\gamma \leq \frac{C_p - K_p}{p^j(L|\omega, \omega')\alpha(\theta_j - \theta_i)}$$

Hence the result. ∎

Proof of proposition 11:

Consider the case of the first type of plaintiffs. Equivalent arguments may be obtained in the case of the second plaintiff and in the case of a class action.

When conditional or contingent fees are introduced, the defendant's best offers to plaintiff i in stage 3 are the following, under assumption 2:

$$
\begin{aligned}
s(\theta_i, \omega) &= \max\left(0, p^i(L|\omega)(\theta_i - C_p)\right) \\
&= p^i(L|\omega)(\theta_i - C_p) : under\ conditional\ fees \\
s(\theta_i, \omega) &= \max\left(0, p^i(L|\omega)(1 - t)\theta_i\right) \\
&= p^i(L|\omega)(1 - t)\theta_i : under\ contingent\ fees
\end{aligned}
$$

i) Thus, whatever the message, the plaintiff always obtains a positive payment - thus, he always accepts the defendant's offer.

ii) As a result, the plaintiff' individual expected utility level in case of individual suits is equal to:

---

[11] Once more, we do not tackle with the problem of multiplicity of equilibria, only focusing on the equilibrium path where the class action is formed.

$$Eu_i(\theta_i, p^i(L|.)) = p_L(\theta_i - C_p) - C = Eu_i(\theta_i, p_L) \qquad (3)$$

Notice that by assumption 1: $Eu_j(\theta_j, p_L) > Eu_i(\theta_i, p_L)$. It is straightforward to see that individual suits are both beneficial for the plaintiffs soon as $Eu_i(\theta_i, p_L) \geq 0$, meaning that their common priors must satisfy: $p_L \geq \frac{C}{\theta_i - C_p}$.

iii) Finally, both contingent and conditional fees (for a normalized cost : $t\theta_i = C_p$) allows for higher settlement offers, given that they induce a decrease in the expected payments from plaintiffs to their attorney:

$$p^i(L|\omega)\theta_i - C_p \;\; > \;\; p^i(L|\omega)(\theta_i - C_p) : under\ conditional\ fees$$
$$p^i(L|\omega)\theta_i - C_p \;\; > \;\; p^i(L|\omega)(1 - t)\theta_i : under\ contingent\ fees$$

as compared to the fixed costs system of the previous section.

?????????**Proof of proposition 12.**?????? More specifically, we now prove the following results:

Claim 15 *Consider that class actions are allowed, and assume that: (C1) $p_L \geq \frac{C}{\theta_i - C_p}$ and (C2) $\alpha \leq \frac{C_p - K_p}{\theta_j - \theta_i}$. When conditional fees apply, there exists a unique SPE associated to the following actions:*
1/ Each plaintiff files.
2/ P_i initiates the class action, and P_j joins it.
3/ The defendant makes sets of offers:

$$s(\theta_i, \omega) \;\; = \;\; p^i(L|\omega)(\theta_i - C_p), \forall \omega \in \Omega\ for\ P_i$$
$$s(\theta_j, \omega, \omega') \;\; = \;\; p^j(L|\omega, \omega')(\theta_j - C_p), \forall(\omega, \omega') \in \Omega \times \Omega\ for\ P_j$$
$$s(\Theta, \omega, \omega') \;\; = \;\; p^j(L|\omega, \omega')(\Theta - K_p), \forall(\omega, \omega') \in \Omega \times \Omega\ for\ a\ CA$$

4/ At each decision node in stage 3 where he has to choose an action, each plaintiff accepts the offer (either individually or as a member of the class action) proposed by the defendant, for each possible information they may receive.

The equivalent result holds for contingent fees.

Proof of claim 15. Assume now that class actions are allowed. Notice that, in such a case where the class action is formed, each plaintiff accepts the collective offer to the class action since $\Theta - K_p > 0$, and both plaintiffs obtain the same expected utility level which is equal to: $p_L(\Theta - K_p) - K$.

Thus consider $P'_j s$ efficient decisions in stage 2. At the decision node where he chooses either to file individually or to join the class action, he chooses to join the class action soon as $\Theta - K_p \geq \theta_j - C_p$ for any combination of messages, meaning that we must have: $\alpha \leq \frac{C_p - K_p}{(\theta_j - \theta_i)}$. Finally, at his first decision node, he

also chooses to file rather than not file if $p_L(\Theta - K_p) - K \geq 0$ or equivalently: $p_L \geq \frac{K}{\Theta - K_p}$.

Consider now $P_i's$ efficient decisions in stage 1; it is straightforward to see that soon as:

$$p_L(\Theta - K_p) - K \geq p_L(\theta_i - C_p) - C \geq 0$$

Then, on the one hand, he prefers to initiate a class action rather than to sue individually (at his decision node following his entry), while on the second he always files rather than opt out the litigation process. Remark that the LHS of this last inequality is always satisfied given that for P_i' when a class action is formed, it induces both an increase in the expected payment at trial ($\Theta > \theta_i$) and a decrease in the litigation costs (assumption 2). For its own, the RHS inequality is satisfied once: $p_L \geq \frac{C}{\theta_i - C_p}$.

Given the assumptions made on the various litigation costs, it is straightforward to show that $\frac{C}{\theta_i - C_p} > \frac{K}{\Theta - K_p}$. Hence the result. ∎