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DIRECT REIMBURSEMENT IN MOTOR LIABILITY INSURANCE

GIAMPAOLO GALLI – CARLO SAVINO (*)

SUNTO

In alcuni paesi europei, nel ramo r.c. auto sono in vigore, tipicamente su base volontaria, sistemi di risarcimento diretto, in base ai quali l'assicuratore risarcisce direttamente il proprio cliente danneggiato e si rivale successivamente sull'assicuratore del responsabile civile. In questo lavoro si analizzano gli effetti del risarcimento diretto sui costi e sulla loro distribuzione fra assicurazioni e categorie di assicurati, confrontando un sistema di compensazione basato su forfait fissi, come quello in vigore in Francia da molti anni e in Italia dal febbraio 2007, con un sistema basato sul confronto bilaterale dei costi medi delle imprese, quale quello che era in vigore in Italia, su base volontaria, sino al 2006. Dalle simulazioni effettuate emerge che i due sistemi non differiscono significativamente fra di loro per quanto riguarda i costi complessivi e la loro distribuzione fra assicuratori e categorie di assicurati. Inoltre, nella maggior parte dei casi, i due sistemi tendono a determinare risultati abbastanza simili a quelli del tradizionale sistema di risarcimento basato sulla liquidazione da parte dell'assicuratore del responsabile civile. Vi sono tuttavia delle eccezioni che è opportuno affrontare attraverso appropriate misure correttive dei sistemi di compensazione fra imprese.

ABSTRACT

In some European countries a large subset of motor liability claims are managed within a direct reimbursement (DR) scheme. In a DR scheme an insurance company handles the claims of its (non responsible) clients, acting on behalf of the insurer of the liable party. There are significant differences across these schemes, but all of them preserve, in compliance with European law, the tort principle. With the standard third party liability reimbursement scheme as a benchmark, we provide some insights on the properties of direct reimbursement

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by comparing a forfait based (FB) scheme, such as the one that is in operation in France, with a claim cost based (CB) scheme, like the one that was used in Italy until 2006. Our simulations suggest that the two schemes are rather similar to each other and are not likely to produce significant departures from a standard third party scheme in terms of expected costs for the system as a whole and for the main categories of consumers. There are exceptions however that may need to be taken care of through appropriate corrective measures.

KEY WORDS AND PHRASES: *Motor liability insurance, Direct reimbursement, Loss settlement, Portfolio selection.*

1. INTRODUCTION

In some European countries – among which, France, Italy, Portugal and Spain – insurers have agreed to participate in direct reimbursement (henceforth DR) schemes for certain types of collisions. In these schemes, once responsibility is ascertained, claimants are indemnified by their own insurance companies, legally acting as agents for the responsible parties' insurers, who act as principals.

All direct reimbursement schemes adopted by member states preserve the principle of tort law, in compliance to a European directive,(1) implying that principal insurers eventually reimburse agent insurers, who have handled claims on their behalf. Direct reimbursement should hence not be confused with no-fault insurance, which is instead adopted in a number of non-European countries. The settlement procedure between insurers typically does not foresee an exact one-to-one compensation for each claim, so as to avoid opportunistic behavior on the part of agents companies, who must have appropriate incentives to control costs.

While there is considerable scientific work on no-fault schemes – see, in particular, the book edited by Cummins (2002), which collects the works of Tennyson et al., Dionne and others(2) –, there does not seem to exist any specific literature on direct reimbursement.(3) Against this background, this paper explains the basic rationale and the functioning

(1) European Council (1972), "Insurance against civil liability in respect of the use of motor vehicles", Directive 72/166/EC, 24 April.

(2) White and Yu-Ping (1999) study the properties of no-fault within a more economic analysis oriented framework.

(3) The basic information about the systems can be found in the web sites on national insurance associations: www.ffsa.fr, www.ania.it, www.apseguradores.pt, www.unespa.es. There are also some papers and documents that refer to direct reimbursement in a broader context. See Candian et al. (2005) and Cucchiarelli and Di Girolamo (2003).

of direct reimbursement and sets up a simple analytical framework to examine the implications of two versions of DR compared with the standard third party (henceforth TP) liability scheme, in terms of total costs and their distribution among companies and categories of consumers.

The two DR schemes that we compare are a forfait-based (FB) scheme and a cost-based (CB) scheme. The details of the two systems are explained in Section 3 below. Essentially, in a FB scheme the (agent) insurer that has handled a claim of its client receives a predetermined sum of money from the (principal) company whose clients have caused the collision. Such sum of money is a fixed value for all claims and does not depend on the actual value of the claim. In France, where this scheme has long been in use on the basis of a voluntary agreement among insurers, such fixed sum of money is called a "forfait".

In a cost based scheme, such as the one that has been in operation in Italy from 1978 to 2006 on the basis of a voluntary agreement amongst insurers, principal insurers refund agent insurers the entire monetary value of the claim on a monthly basis. In order to avoid moral hazard, periodically (once a year) a settlement among companies takes place based on bilateral comparisons of costs. The aim is to penalize the less efficient members of the system or, in any case, those that have been excessively lenient towards their clients.

At the beginning of 2007, Italy has switched to a forfait-based scheme, which is no longer the result of a voluntary agreement among insurers, but has been imposed by law, for a large set of claims.[4] The system is compulsory for consumers, who must present their claims to their own company and, in case of disagreement, should sue such company, and not the company of the party whom they deem responsible. It is compulsory for the companies as well, since they cannot refuse to handle the claims of their clients and must participate in the forfait-based settlement procedure.

This paper is largely motivated by the debate that took place in Italy when the decision was taken to switch from the old voluntary cost-based scheme to the new compulsory forfait-based scheme. Insurers feared that the forfait-based scheme could determine large redistributions of costs among companies and categories of consumers and that,

[4]Italian Parliament (2005), "Codice delle Assicurazioni Private", Law of 7 September 2005, n. 209 and Decreto del Presidente della Repubblica, 18 July 2006, n. 254. An insight on the legal aspects of the new system can be found in Capriglione (2007, editor).

being based on a single standard, could have negative effects on their ability to set prices so as to select more careful drivers. The Antitrust Authority, who was an active subject in the debate, thought that the old scheme was too exposed to moral hazard and that it required an excessive exchange of information among competitors.[5] Most importantly, consumers' associations and many independent observers thought that switching to a compulsory, hence generalized, system would help contain the rise in premium rates that in the preceding years had been quite sizeable.

The results of this study, derived analytically and through numerical simulations, can be summarized as follows.

1) Direct reimbursement schemes are likely to improve the quality of the loss settlement service and the relationship between insurers and policyholders. The effects on total costs and prices are uncertain, especially in the short run, and may crucially depend on the legal and technical details of the system.

2) Switching to direct reimbursement is unlikely to cause major changes in the distribution of costs across companies and categories of consumers. There are however specific exceptions that may need to be taken care through appropriate corrective measures.

3) The two schemes (FB and CB) appear very different, but they do in fact deliver very similar results in terms of costs and their distribution.

4) They are both equally exposed to some moral hazard problem that can be attenuated by an appropriate design of the system.

The paper is organized as follows. Section 2 examines the basic rationale behind the proposal to switch to generalized direct reimbursement. Section 3 explains the mechanics of the forfait based and claim cost based schemes and proposes the basic analytical framework. In section 4 we use this framework to simulate the functioning of the three systems under different realistic assumption about costs, frequencies and distribution of categories of policyholders across companies and regions of a country; some moral hazard issues and the implications of the different schemes for competition policy are discussed in the final part of this same section. Section 5 draws the conclusions of the analysis.

[5] Autorità Garante per la Concorrenza e il Mercato (2003), "Indagine Conoscitiva sul Settore Assicurativo Autoveicoli", Decision n. 11891, 17 April, (www.agcm.it).

2. The rationale behind the proposal

Proponents of direct reimbursement, such as the Italian Antitrust Authority,[6] point at two possible benefits of this system relative to standard third party (TP) scheme.

1. In DR schemes, insurance companies handle the claims of their own clients. This creates healthy competition among insurers on the quality of the service: if the service is not judged satisfactory, policyholders may decide to change for another company. In a TP scheme, instead, policyholders need not care at all about quality. They purchase motor liability coverage from an insurer but, if they suffer unjust damages, they are reimbursed by some other insurer for which they are normally unknown subjects. A related point is that in a direct relationship clients are less likely to try to commit fraud against their company.
2. In a direct relationship, it should be easier to induce claimants to resort to repair shops and/or physicians within networks of suppliers tied contractually to their insurance company. Insurers may offer discounts to subscribers that commit to resort exclusively to such networks in case of accident. They may also propose to handle reparations and lend substitute cars to clients. These arrangements may lead to cost reductions by providing additional cost control devices in all the phases of the claim handling process: opportunistic behavior by clients, repairers, lawyers and other subjects involved in the loss arrangement process may therefore be reduced.[7]

The first argument is quite clear and may be very important in terms of improving the perception of insurers by consumers in the long run.

It is not clear however whether it can generate positive effects on costs and prices. *Per se*, tougher competition on quality implies higher, not lower costs. Precisely because companies are serving their clients, rather than unknown third parties, they will tend to be more accommodating when dealing with their requests. A better service, however desirable in its own right, is more likely to increase costs and prices.

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[6] *Ibid.* See also Cucchiarelli and Di Girolamo (2003).

[7] Indeed, it is often stressed that fraudulent behavior is more likely to arise in standard third party liability insurance schemes. See, for example, Porrini (2006) and Buzzacchi and Schena (1997). A similar point is made in Marchionni (2006).

However, if the perception of insurers improves, it is possible that in the long run there will be fewer attempts to commit small frauds, much in some way as it is usually thought that tax evasion is larger in countries in which the government is perceived to provide insufficient services. Indeed in several countries there is no moral stigma on people who cheat the government or an insurance company. We believe this positive effect may work after a fairly long period of time and certainly requires more adjustments than just changing the reimbursement scheme in motor liability insurance.

The second argument requires no particular comment, except that for costs to be reduced it is necessary that companies put in place appropriate contractual provisions as well as an appropriate system of relations with all the subjects involved in the loss adjustment process, including the claimants. Essentially, a major change in terms of industrial organization is needed.

A further point is related to the difference between a voluntary and a compulsory system. In a voluntary system, i.e. one that is set up on the basis of a private agreement among all or most insurers, consumers are typically free to use or not to use the DR scheme. They may resort to it, because they prefer to deal with their own company or because the rules of the game involve a shorter time for cashing the money. The point is that their legal rights cannot be changed by an agreement among insurers. Instead in a compulsory system, the law may change legal rights. In the case of the system that has been implemented in Italy since 2007, the law prescribes that consumers must resort to the DR scheme (for a large set of claims). If the claim is handled satisfactorily by the company within a prescribed period of time,[8] consumers do not have the right to ask such company to reimburse expenses for legal advise they have eventually incurred. Only in case of litigation, consumers recover the right to claim legal expenses. This is a relatively important difference with the standard TP system, in which consumers were used to resort to legal experts in order to file their claims with the third part company. With the new system a relatively important component of costs may hence be reduced, both because legal expenses cannot be claimed unless there is litigation and because litigation is less likely to occur.

[8] The company must respond within 30 or 60 days (depending on whether the two drivers have or have not signed a common form describing the accident) for material damages and within 90 days for bodily damages.

As pointed out by Carrol (1991), the reduction of legal costs has been one of the key motivations behind the choice of no fault systems in some states of the US.[9] In principle, a pure no fault system should about double total costs of the compulsory component of motor liability insurance because both parties in an accident can be reimbursed, independently of responsibility. The counterargument however is that in such system consumers, in most cases, lose the right to sue the person (and her/his company) that they deem responsible for the accident and that the ensuing savings in litigation costs may be so large as to determine a reduction in total costs relative to a standard third party liability system. Direct reimbursement is not a no fault system, implying that litigation costs about responsibility do remain a relevant component of system. Nonetheless, there may be a reduction in legal costs.

3. Key features of direct reimbursement schemes

The various existing DR schemes differ in many respects. Here we choose to focus on the intra-company settlement schemes and on the degree of connection between the transfer made by principal insurers and the claim costs borne by agent insurers. We will therefore consider two schemes. In the first one – the forfait based scheme – the amount of money involved in each transfer is fixed ex-ante (in French, "forfait"), and therefore independent of the cost involved in the claim. In the second one – the claim cost based scheme – the transfer is calculated taking into account such cost, although not on a one-to-one basis.

3.1. A forfait-based system

In the basic forfait-based DR scheme, principal insurers pay agent insurers for each claim managed in their behalf a pre-determined amount (the forfait), which is typically independent of the actual costs involved.

The process leading to the final cost to a given insurer can be described in two steps.

Step 1. *Reimbursement.* A given insurer reimburses its own clients. At this stage total costs of the company are given by the product of collisions suffered by its clients times their average cost. Note that,

[9] On this point, see also, Mayers and Smith (1981); Witt and Urrutia (1983); Powers (1993); Schmit and Yeh (2003) and Harrington and Niehaus (2004).

generally speaking, these costs depend on a different set of variables with respect to those that are relevant in the standard third party scheme.

Step 2. Settlement among companies. The insurer receives the forfait from each of the principal insurers whose clients have caused a collision to its policyholders. At the same time, it pays the forfait to each of the agent insurers for each collision caused by its policyholders to their clients.

After Step 2, total costs of the insurer are equal to the sum of the costs borne in step one plus the value of the forfait multiplied by the difference between the number of collisions caused and those suffered by its clients.

Some countries have adopted this scheme in their direct reimbursement systems. In France, motor insurers participate in a non-compulsory system based on a forfait that has been running since 1965. The amount of the forfait is set at the beginning of the current year based on the previous year's average claim costs of the whole sector corrected by a forecast of future inflation. It is calculated by IRSA, a consortium of insurance companies purposefully formed. The forfait is the same across firms, regions and types of vehicles.(10)

In Italy, a compulsory forfait-based system has been recently established by law. Since February 2007 all eligible claims(11) are to be handled directly by the insurer of the affected parties. Settlements between insurers are carried through a fixed payment, whose value is the same regardless of whether the claim involves only material damages or extends to bodily injuries.(12) As explained in Section 2, the main differ-

(10) The scheme is applicable to collisions between two vehicles implying material damages for less than a given threshold (6,500 euros in 2005). Above such threshold and for collisions involving more than two vehicles, the principal company reimburses the actual cost of each claim handled by the agent company. Bodily damages are handled with different rules. In 2005 the value of the forfait was 1,204 euros per claim. For additional information, see www.ffsa.fr.

(11) Namely, all claims stemming from collisions between two vehicles, involving material damages (with no limits) as well as permanent bodily injuries up to a given degree (9%) measured by an official disability scale.

(12) According to the law, the forfait varies in the different provinces of the country, of which there are 110. It can take on three different values (for 2006, euros: 1,800; 2,000; 2,300), depending on whether the average cost of material damages in a given province is classified as low, intermediate or high. The rationale is that the value of human life is the same in all provinces, while the cost of repairing cars may differ.

ence between the Italian and the French scheme lies in the compulsory nature of the latter. The new Italian system impacts significantly on relationship between the parties involved in an accident, allowing the damaged party to take any legal action for damages against his own insurer, not the other party's.

A key feature of forfait-based systems is that they generate an externality on agent companies, by exposing them to a loss for every claim involving a reimbursement higher than the forfait or a gain if the amount reimbursed happens to be lower.

This can be better appreciated with the help of expression (1) for expected claims costs per policy, or "pure premium":[13]

$$\pi^{\mathrm{FB}}(i) = \frac{C^{\mathrm{FB}}(i)}{p(i)} = f^v(i) \cdot c^v(i) + F \cdot [f^r(i) - f^v(i)] \tag{1}$$

where $\pi^{\mathrm{FB}}(i), C^{\mathrm{FB}}(i)$, and $p(i)$ stand respectively for pure premium, expected claims costs and number of policyholders of company i, under the forfait based (FB) scheme. $f^v(i)$ is the frequency of accidents "suffered" by clients of i (denoted by the superscript v, for "victims"), while $f^r(i)$ is the frequency of accidents "caused" by clients of i (denoted with the superscript r, for "responsible"). $c^v(i)$ stands for average costs per claim. It has the superscript v to indicate that this is the average cost of accidents "suffered" by clients of a given company i and handled by the same company.[14] F stands for the monetary value of the forfait.

The first part of this expression (before the plus sign) measures total costs per policy after Step 1 of the procedure (the amount effectively disbursed by the agent company). The second part is the effect of Step 2 (settlement amongst companies).

It is useful to rewrite expression (1) in the following way:

$$\pi^{\mathrm{FB}}(i) = f^r(i) \cdot c^v(i) + \varepsilon^{\mathrm{FB}}(i) \tag{2}$$

$$\varepsilon^{\mathrm{FB}}(i) = [F - c^v(i)] \cdot [f^r(i) - f^v(i)]\,. \tag{3}$$

[13] Usually the term "pure premium" is associated with objective factors related to the characteristics of the policyholders (it measures the, private and social, cost of their risk). In this analysis, instead, we have different premiums, depending on such conventional factors as which company reimburses the claimant and how settlements schemes among companies are designed.

[14] In the notation of this paper, like in companies' accounts, both frequencies and costs are adjusted to account for cases in which responsibility is shared. For instance a 40% share of responsibility counts for 40% both for frequency and for costs.

Expression (2) can be compared with the usual expression for pure premium within a standard third party (TP) scheme:

$$\pi^{\mathrm{TP}}(i) = f^{r}(i) \cdot c^{r}(i)\,. \tag{4}$$

This is just frequency (of collisions *caused* by clients of i) times the average cost of such collisions (i.e. *caused* rather than *suffered* by clients of i). Expressions (2) and (4) are rather similar: they yield exactly the same result when $c^{r}(i) = c^{v}(i)$ and $\varepsilon^{\mathrm{FB}}(i) = 0$. The first condition depends essentially on the portfolio mix of the company. The second condition is met when either the average cost of company i is equal to the forfait (which can be presumed to approximate the average cost of the system) or the frequency of collisions caused by clients of i is equal to the frequency of collisions suffered by them.

3.2. A CLAIM COST BASED SCHEME

The most relevant feature of a claim cost based scheme is that it maintains a linkage between transfers made to the agent insurer and the respective costs of the claim. The same linkage cannot survive in a scheme based on the forfait, for its pre-determined nature.

A one-to-one relationship, however, is not likely to elicit proper cost-containment incentives on the claim handler, who would be induced to be lax on reimbursing its own policyholders. Therefore, some correction mechanism is needed.

One DR scheme displaying these characteristics is the non-compulsory direct reimbursement scheme set up in Italy in 1978 and in operation until the end of 2006.

In such scheme, eligible claims[15] are managed as follows. At the end of each month, principal insurers refund agent insurers the entire monetary value of the damages. Once a year, a final settlement among

[15] In the old Italian scheme a claim could be managed according the DR scheme provided the concurrence of the following conditions: a) no more than two vehicles involved in the collision; b) both drivers signing a joint statement describing the circumstances of the accident; c) no legal intermediaries between the claimant and the company. The scheme applied to all material damages to the vehicle (without limits), as well as to bodily injuries (of the driver and passengers) and transported goods up to a value of 15,000 euros. In 2006 it covered slightly less than 30% of all accidents (about 1 million accidents out of a total of 3.6 millions).

companies takes place in a central clearing room. The settlement is based on bilateral comparisons of costs. Company A pays company B the net amount (positive or negative) resulting from the difference between its average cost in handling accidents as an agent of B and B's average cost in handling accidents as an agent of A, multiplied by the number of collisions caused by the clients of the company with the lower cost. This latter step penalizes companies that are either inefficient or too benevolent to their own clients.

There are hence three steps in this procedure.

Step 1. Reimbursement of own clients. Same as in the forfait based scheme.

Step 2. "Pay back" amongst companies, which takes place monthly.

Step 3. Final settlement, which takes place at year-end, according to the rule described above.

The procedure can best be explained with a simple two companies example.

	Company A	Company B
Number of claims	$k(B,A) = 100$	$k(A,B) = 90$
Average cost	$c(A) = 20$	$c(B) = 25$
Costs reimbursed to own clients (Step 1)	$100 \times 20 = 2{,}000$	$90 \times 25 = 2{,}250$
Pay back to agent company (Step 2)	2,250	2,000
Settlement (Step 3)	$90 \times (20 - 25) = -450$	$90 \times (25 - 20) = 450$
Final cost (2+3)	1,800	2,450

Company A has handled 100 claims as an agent for B, i.e. for collisions caused by clients of B to clients of A, which we denote as $k(B,A)$. The average cost of such claims, $c(A)$, is 20 euros. Company B has handled 90 claims, $k(A,B)$, as an agent for A at an average cost, $c(B)$, of 25 euros. Therefore, in Step 1 company A pays out to its clients 2,000 euros and company B pays out 2,250. In Step 2, companies exchange costs (claim by claim reimbursement): A gives B euros 2,250 (what B has spent to handle collisions caused by clients of A) and B gives A euros 2,000. Step 3 is computed as follows:

$$k(A,B) \times [c(B) - c(A)] = 90 \times (25 - 20) = 450\,. \tag{5}$$

Since the average cost of A is lower than the average cost of B by $25 - 20 = 5$ euros, B owes A euros 5 times the number of collisions

caused by A, $k(A,B)$. Note that, rearranging terms, final costs for A can be computed as:

$$k(A,B) \times c(A) = 90 \times 20 = 1,800\,. \tag{6}$$

This is (almost[16]) the same expression that yields total costs under a standard third party scheme. This result derives from the basic logic of the system, whereby in Step 3 company A receives a net payment which is equal to the extra cost sustained by B, and transferred to A in Step 2, due to B's relative inefficiency. In other words, the procedure aims at burdening A only with those costs that it would have sustained if it had handled its 90 accidents as in a standard third party scheme.

In turn, final costs of B can be computed as:

$$k(B,A) \times c(B) + \varepsilon = (100 \times 25) - 50 = 2,450 \tag{7}$$

where:

$$\varepsilon = [k(B,A) - k(A,B)] \times [c(A) - c(B)] = -50\,. \tag{8}$$

The first part of this expression (10×25) is (almost) the same as in a third party scheme. The term ε is a necessary correction to satisfy the constraint that settlements amongst companies must sum up to zero $(2,000 + 2,250 = 1,800 + 2,450 = 4,250)$.[17]

Generalizing the above formulas to more than two companies and dividing by the number of policyholders, one can write the following expression for the pure premium of company i under the claim cost-based (CB) scheme:

$$\pi^{\mathrm{CB}}(i) = \frac{C^{\mathrm{CB}}(i)}{p(i)} = f^r(i) \cdot c^v(i) + \varepsilon^{\mathrm{CB}}(i) \tag{9}$$

$$\varepsilon^{\mathrm{CB}}(i) = \frac{1}{p(i)} \cdot \sum_j [k(i,j) - \gamma(i,j)] \cdot [c^v(i,j) - c^v(j,i)] \tag{10}$$

[16] "Almost" because the clients of A may have different characteristics from those of B, for instance because A insures cars which are heavier and tend to cause larger damages than the cars insured by B. Thus $c(A)$ is the average cost of A, when A handles cars that have suffered an accident from $B's$ clients.

[17] Note that in this example aggregate costs (4,250 euros) happen to be lower than under a third party scheme, in which they would be $4,300 = (90 \times 20) + (100 \times 25)$. This is due to the fact that company A, which is more efficient, handles a larger number of claims (100 rather than 90) than in a TP scheme.

where:

$$\gamma(i,j) = \begin{cases} k(i,j) & \text{if } c^v(j,i) \leq c^v(i,j) \\ k(j,i) & \text{otherwise} \end{cases} \tag{11}$$

$k(i,j)$ is the number of collisions caused by clients of i to clients of j and $c^v(i,j)$ is the average cost of such collisions, when handled by the company of the "victim", which, in this case, is company j. Symmetrically, these definitions hold for $k(j,i)$ and $c^v(j,i)$.

A typical term in the summation over all j companies in expression (10) is zero whenever the average cost borne by i in handling accidents caused by clients of j is lower than the reciprocal (cost borne by j in handling claims for i). In this case, by the definition of $\gamma, k(i,j) = \gamma(i,j)$. If a company's costs are lower than anyone else's in all bilateral comparisons, then its ε^{CB} term is equal to zero. Its pure premium is hence (almost[18]) identical to that prevailing under standard TP, as was the case for company A in the above two companies example.

An implication to be noted is that expected claims costs of a company depend on how such company ranks in terms of average costs relative to all other companies participating in the settlement scheme. Hence knowledge of the characteristics of the policyholders and of the settlement scheme is not sufficient to determine pure premiums. In principle, an actuary should also acquire information about the ranking of her/his company relative to all other companies in terms of costs. This feature of the system may make it rather difficult to compute pure premiums and tariffs, although in practice, in the Italian experience, it does not seem to have been perceived as a relevant problem.

4. Simulations

Using these formulas, we run some numerical simulations to gain insight on the basic properties of the different schemes (see tables 1 to 11).

We consider three firms of different size: S (for small), M (for medium) and R.o.M. (rest of market). To each one we associate a claims frequency and an average cost per claim. The results, in terms of expected claims costs per policy (ECCs), are then computed for the

[18] In the same sense and for the same reason as in footnote 13.

standard third party (TP) scheme and for the two direct reimbursement (DR) schemes: forfait based (FB) and cost-based (CB).

In order to focus on the key issues, we start by making some restrictive assumptions on the general model. The effects of relaxing such assumptions will be seen one at a time.

4.1. Basic model

The first set of exercises is performed under the following assumptions:

A1. *Average costs per claim differ across companies only because of differences in the efficiency with which companies handle the claims.*

This implies the following equalities, which allow us to drop a large number of indexes and superscripts:

$$c^r(i,j) = c^v(i,j) = c^r(i) = c^v(i) = c(i) \quad \text{for all} \quad i \quad \text{and} \quad j. \tag{12}$$

Average costs depend only on the company (i) who handles the claim, regardless of the type of collision (caused by i or caused by j) and regardless of whether such company is acting as a principal (as in a standard TP scheme) or as an agent (as in DR schemes).

Assumption A1 implies that companies do not differ too much in their portfolio mix. Otherwise, for instance, average costs would be higher for companies who insure more powerful or heavier cars, which, in a collision, tend to cause larger damages to third parties than smaller cars.

We hence isolate a single dimension of costs, the one that depends on companies' efficiency. This dimension is of crucial importance because we want to make sure that competitive pressure among companies is not reduced or eliminated by moving away from TP. In principle the less efficient company should either restructure or lose market share in favor of more efficient companies.

A2. *Geography does not matter*

This means that either the country is homogeneous (in terms of frequencies and claims costs) or, if not, market shares of the different companies are the same across the different (non homogeneous) areas.

Assumption A2 is crucial for the cost-based scheme, and will be relaxed in a specific paragraph that deals with geographical clusters[19]. Conditional on these assumptions, we consider two polar cases:

Case 1. For each company, $f^v(i) = f^r(i)$. In words, the average frequency of collisions without responsibility, or "collisions suffered" by clients of the company, is equal to the frequency of collisions with responsibility, or "collisions caused" by clients of the company.

Case 2. For each company, $f^v(i) = f$, where f is the aggregate frequency of the system. In words, all drivers have the same probability of being hit by a third party, although the probability of causing an accident differs across clients of different companies. In this case, for each company, the average frequency of collisions without responsibility is independent from the frequency of collisions with responsibility.

Reality is likely to be a mixture of Case 1 and Case 2, and it would be easy to run simulations with elements of both. This would not however be very informative, relative to considering the two polar cases of perfect correlation and zero correlation between the two notions of frequency.[20] Negative correlation does not seem to be a relevant possibility.[21]

Case 1 is probably the more relevant case in reality because drivers who use the car less often (e.g., in some countries, females relative to males) are both less likely to hit and to be hit than frequent drivers. Reckless drivers (e.g., very young people) are more likely not only to cause an accident, but also to put themselves in dangerous situations and therefore be hit by third parties.

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[19] This assumptions allows us to recover each cell of the collision matrix, $k(i,j)$, as the product of the collisions "caused" by i's policyholders times the collisions "suffered" by j's policyholders, divided by the aggregate number of collisions in the system. Conditional on an accident occurring and on A2, the events "i hits anyone" and "j is hit by someone" are independent. Their product hence gives the probability that an accident is of type "i hits j". This would not be the case if clients of the two companies were located either close together (in which case $k(i,j)$ would be larger) or far apart (in which case it would be smaller).

[20] Given the constraint that the number of collisions "caused" must equal the number of collisions "suffered", unit correlation implies that for each company the frequency of collisions with responsibility be equal to the frequency of collisions without responsibility, as assumed under Case 1.

[21] A possible exception might be suggested by persons who usually drive at an annoyingly low speed on a highway.

Case 2 is however useful to isolate the effects of the most common notion of "frequency" in standard third party schemes.

Under assumptions A1 and A2, in Case 1 we get the following:

RESULT 1. – *The three systems yield identical ECCs in the aggregate and for each company, regardless of cost differentials across companies* (*Table* 1).

Table 1 – Same probability of hitting and being hit.

	Assumptions			Expected claim costs: euros		
	Market shares (in %)	Frequency of claims (*) (in %)	Average cost per claim (euros)	Standard third party	Direct reimbursement	
Company:					Forfait based	Cost based
Small	2.0	7.0	4.0	0.280	0.280	0.280
Medium	15.0	8.0	5.0	0.400	0.400	0.400
Rest of Market	83.0	9.0	6.0	0.540	0.540	0.540
Total/average	100.0	8.8	5.8	0.514	0.514	0.514

(*) Frequency of accidents "caused" = frequency of accidents "suffered" by clients of the company.

The intuition behind result 1 is quite simple. Looking at equation (1), under the forfait based scheme, no transactions will be expected to take place in the settlement system amongst companies because, by assumption, the frequency of accidents caused by clients of one company is equal to the frequency of accidents suffered. This implies that the value at which the forfait is set is irrelevant.[22] Both the remaining terms of the equation are equal to the corresponding terms of the familiar TP equation. The first one because of the assumption made under Case 1, implying that $f^v(i) = f^r(i)$; the second one because of assumption A1, implying $c^v(i) = c^r(i)$. A similar explanation applies to the CB system: formally, under Case 1, the collision matrix is symmetric, implying that in equation (10) $\varepsilon^{\mathrm{CB}}(i) = 0$ for all i.

Result 1 suggests that, at least under some circumstances, the three systems tend to yield similar result for the companies as well as and for their clients.

[22] Of course, these results hold in expected value sense. Ex post, the number of accidents caused and suffered may be different: hence F may have some relevance.

We now turn to Case 2, which implies $f^v(i) = f$ for all companies, where f is the aggregate frequency of the system. Under these assumptions (A1, A2, Case 2), we can rewrite the expressions for pure premiums in the three schemes in a very simple and compact form:

$$\pi^{\mathrm{TP}}(i) = f^r(i) \cdot c(i) \qquad \text{(Standard third party)} \tag{13}$$

$$\pi^{\mathrm{FB}}(i) = \pi^{\mathrm{TP}}(i) + \varepsilon^{\mathrm{FB}}(i) \tag{14}$$

$$\varepsilon^{\mathrm{FB}}(i) = [f^r(i) - f] \cdot [F - c(i)] \qquad \text{(Forfait-based scheme)} \tag{15}$$

$$\pi^{\mathrm{CB}}(i) = \pi^{\mathrm{TP}}(i) + \varepsilon^{\mathrm{CB}}(i) \tag{16}$$

$$\varepsilon^{\mathrm{CB}}(i) = \sum_{j=1}^{i} w(j) \cdot [f^r(i) - f^r(j)] \cdot [c(j) - c(i)] \qquad \text{(Claim cost-based scheme)} \tag{17}$$

where $w(j)$ is the market share of company j. Note that to derive equation (16) from equation (9), without any loss of generality, we have ordered companies according to their average costs, so that $c(i) < c(j)$ if $i < j$. For the reasons explained above, the most efficient company will have: $j = i$, hence $\varepsilon^{\mathrm{CB}}(i) = 0$.

With these equations, which are used for the simulations of tables 2 to 6, the following results are intuitive or can easily be proved:

RESULT 2. – *The three systems (TP, FB and CB) yield exactly the same ECCs both in the aggregate and for each company if companies either: a) have the same frequencies (see Table 2), or b) have the same average costs per claim (Table 3).*

Table 2 – Probability of being hit independent of probability of hitting. (Same frequencies and different costs)

	Assumptions			Expected claim costs: euros		
	Market shares (in %)	Frequency of claims (in %)	Average cost per claim (euros)	Standard third party	Direct reimbursement	
Company:					Forfait based	Cost based
Small	2.0	8.0	4.0	0.320	0.320	0.320
Medium	15.0	8.0	5.0	0.400	0.400	0.400
Rest of Market	83.0	8.0	6.0	0.480	0.480	0.480
Total/average	100.0	8.0	5.8	0.465	0.465	0.465

Table 3 – Probability of being hit independent of probability of hitting. (Same costs and different frequencies)

	Assumptions			Expected claim costs: euros		
Company:	Market shares (in %)	Frequency of claims (in %)	Average cost per claim (euros)	Standard third party	Direct reimbursement	
					Forfait based	Cost based
Small	2.0	7.0	5.0	0.350	0.350	0.350
Medium	15.0	8.0	5.0	0.400	0.400	0.400
Rest of Market	83.0	9.0	5.0	0.450	0.450	0.450
Total/average	100.0	8.8	5.0	0.441	0.441	0.441

Result 2 reinforces the presumption that the three systems tend to yield rather similar results. Note however that, contrary to Result 1, this result holds with respect to the FB scheme only if the value of the forfait (5.8 euros in Table 2 and 5.0 in Table 3) is equal to the actual average cost incurred by the system in a given period.

If both frequencies and costs differ across companies (Tables 4-5), we get the following:

RESULT 3. – *Aggregate ECCs are identical in the two DR schemes. They are lower than in TP (by* 0.002 *in the example of Table* 4*) if costs and frequencies are positively related and, vice versa, if they are negatively related.*

Table 4 – Probability of being hit independent of probability of hitting. (Positive correlation between costs and frequencies)

	Assumptions			Expected claim costs: euros		
Company:	Market shares (in %)	Frequency of claims (in %)	Average cost per claim (euros)	Standard third party	Direct reimbursement	
					Forfait based	Cost based
Small	2.0	7.0	4.0	0.280	0.247	0.280
Medium	15.0	8.0	5.0	0.400	0.393	0.400
Rest of Market	83.0	9.0	6.0	0.540	0.540	0.538
Total/average	100.0	8.8	5.83	0.514	0.512	0.512

RESULT 4. – *Spreads between ECCs of the three companies, as measured by the standard deviation around the mean, are higher in the FB scheme* (0.119) *than in TP* (0.106) *and slightly lower in the CB scheme* (0.105).

RESULT 5. – *On average, in the CB system, individual companies' ECCs are closer to TP than in the FB system: the standard deviation of percent differences is* 0.2% *against* 5.2% *of the FB system.*

RESULT 6. – *In the CB scheme the most efficient company* (*Small*) *has exactly the same ECCs as in TP. In the FB system, the largest company* (*R.o.M.*) *has almost the same ECCs as under TP.*

Some of these results are very general, some are not. A very general result is that aggregate ECCs are the same in the two DR schemes. This is due to the fact that net settlements among companies must sum up to zero. Different settlement schemes may only affect the distribution of costs across companies and their clients.

The second statement in Result 3 (aggregate ECCs lower under DR than under TP if costs and frequencies are positively related and vice versa) depends on the fact that, with a positive relation, under a DR scheme, relatively more efficient companies (say, S rather than R.o.M.) handle a larger number of claims than under TP because their frequency (7% in the case of S) is lower than aggregate frequency (8.8%). Hence clients of S suffer a greater number of collisions than those for which they are responsible. The opposite is true with a negative relation.

The important consideration that emerges from the above reasoning is that, even under Case 2, it is extremely unlikely that DR schemes yield aggregate ECCs that are significantly different from TP. The differences that may emerge depend crucially on the combination of three factors: differences in efficiency across companies, redistribution in the number of claims handled by more or less efficient companies and the relation between costs and frequency. Aggregate ECCs are hence likely to be the same if companies do not differ too much in terms of cost efficiency or frequencies. Even if they differ on both these dimensions, aggregate ECCs do not change relative to TP, if there is no clear pattern of correlation (either positive or negative) between costs and frequencies (see Table 5).[23]

[23] The relevant notion is the cross-company correlation between costs and frequencies, weighted by market shares.

Table 5 – Probability of being hit independent of probability of hitting. (Zero correlation between frequencies and costs)

	Assumptions			Expected claim costs: euros		
	Market shares (in %)	Frequency of claims (in %)	Average cost per claim (euros)	Standard third party	Direct reimbursement	
Company:					Forfait based	Cost based
Small	2.0	7.00	5.0	0.350	0.336	0.350
Medium	15.0	8.00	6.0	0.480	0.482	0.480
Rest of Market	83.0	7.77	7.0	0.544	0.544	0.544
Total/average	100.0	7.79	6.81	0.530	0.530	0.530

Result 4 has some interest because it is sometimes thought that a forfait-based scheme should reduce spreads (or tariff personalization) since the settlement system is based on a single aggregate parameter. As we shall see, this may be true in some very specific cases (for the claim cost-based scheme as well as for the forfait-based one), but, on technical grounds, it is by no means a general result.

Result 5 says that the claim cost based settlement scheme, being based on bilateral comparisons of costs, is less likely to produce significant deviation from TP, than the forfait based scheme.(24)

Finally, result 6 states that in the cost-based scheme ECCs of the most efficient company are the same as in TP.(25) As to the forfait-based system, result 6 states essentially that the size of a company does matter. This is because a large company has a greater weight in shaping the value of the forfait than a smaller company. Note however that this needs not be an advantage for the large company. Indeed, in the case of Table 4 the reduction in aggregate ECCs relative to TP brings proportionally larger benefits to companies S and M than to the largest company.

In any case, this feature of the forfait based system could be corrected by fixing the forfait at a different level: for example the median

(24) A more detailed analysis, available on request, shows that this statement holds under a wide variety of configurations of parameter values (market shares, frequencies and costs), as long as costs are made to depend more on companies efficiency than on the specific characteristics of the mix of clients (see Section 4.3).

(25) This is due to the fact that, as has been explained in Section 3, in the settlement procedure (step 3 above) the relevant differences in average costs are weighted by the number of accidents of the more efficient company.

rather than the mean of the system. In practice, this might involve rather difficult negotiations among members of the system.

The next exercise (Table 6) is useful to inquire into the consequences of fixing the forfait at a different value from average costs. To make a clear point, in the exercise the forfait is set at zero and costs per claim are set at the same value for all companies. We then have:

RESULT 7. – *In the forfait-based scheme, aggregate ECCs are invariant with respect to the forfait.*

Table 6 – Probability of being hit independent of probability of hitting. (Forfait based with forfait = 0)

	Assumptions			Expected claim costs: euros		
	Market shares (in %)	Frequency of claims (in %)	Average cost per claim (euros)	Standard third party	Direct reimbursement	
Company:					Forfait based	Cost based
Small	2.0	7.0	5.0	0.350	0.441	0.350
Medium	15.0	8.0	5.0	0.400	0.441	0.400
Rest of Market	83.0	9.0	5.0	0.450	0.441	0.450
Total/average	100.0	8.8	5.0	0.441	0.441	0.441

RESULT 8. – *In the forfait is set at zero, frequency with responsibility becomes an irrelevant factor in shaping individual companies' ECCs. Companies no longer have an incentive to select cautious drivers. More generally the lower the value of the forfait, the smaller the incentive to classify drivers according to frequency.*

Contrary to what is sometimes thought, the value of the forfait does not affect average tariffs, but it does affect their dispersion around the mean, at least under the assumption of Case 2 (it is instead irrelevant under Case 1, as we have already shown). If the forfait is set too low, good and bad drivers will no longer pay the efficient price for the social cost of their conduct.

Result 7 is undisputable on strictly technical grounds. However, the value of the forfait may have a psychological or indirect effect, rather than a technical one. If the body (typically composed of experts representing the companies) decides to increase its value by x% relative to the previous year, this may be taken by companies, as well by consumers,

as a signal that costs (and prices) are forecast to rise by x%. This feature may help maintaining costs under control, as has been argued for instance by the French supervisory authority,[26] but may also expose the system to inappropriate political pressures.

The next step is to relax assumptions A1 and A2, along different possible gradients. We start with the one that is perhaps the most relevant in practice: clusters of companies in different geographical areas, where drivers have different characteristics.

4.2. Geography

The key results are shown in tables 7 and 8, where it is assumed that there are two geographical areas: N an S. 70% of the insured population is assumed to reside in N and 30% in S. The three companies have different market shares in the two areas: for instance, company Small has a 2% market share in N and a 15% share in S; vice versa for company M. The two areas differ as far as frequency of accidents (6% in N and 8% in S). They also differ with respect to average costs per claim (on average, 7.8 euros in N and 4.7 in S), for instance because cars that circulate in N are more expensive to repair than cars that circulate in S or because, in the courts, human life and bodily injuries have a higher value in N.

Within each cluster we maintain assumptions A1 and A2. The novelty is that, due to clustering, these assumptions no longer apply on average, i.e. at the national level. Thus, even if the three companies were identical in terms of efficiency, they would differ, in terms of average costs, because their clients are clustered in one of the two areas.

We are still assuming, for the sake of generality, that companies have different levels of efficiency (Small being the most efficient company both in N and in S), but the key difference now is between the average cost of compensating for the loss occurred to a (cheaper) car, or person, in S and to a (more expensive) car, or person, in N.

As concerns frequencies, there is no longer any need to analyze separately Case 1 and Case 2, because we already know that in Case 1 (equal probability of hitting and being hit), the results would be identical for all three schemes. We hence concentrate attention on the more complex Case 2 (all drivers have the same probability of being hit).

[26] See ISVAP (2000).

With this setting, we have the following:

RESULT 9. – *If frequencies are the same for all companies in each area, the three systems yield identical ECCs in the aggregate, for each company and in each area.*

This result, illustrated in Table 7, should not be too surprising, since it is essentially an extension of Result 2 above.

Table 7 – Geography. (Same frequencies and different costs in each area).

	Assumptions						Expected claim costs: euros			
	Market shares (in %)		Freq. of claims (in %)		Average cost per claim (euros)		Standard third party	Direct reimbursement		
								Forfait based		Cost based
								1 forfait	2 forfait	
Company:	N	S	N	S	N	S				
Small	2.0	15.0	6.0	8.0	6.0	3.0	0.268	0.268	0.268	0.268
Medium	15.0	2.0	6.0	8.0	7.0	4.0	0.415	0.415	0.415	0.415
Rest of Market	83.0	83.0	6.0	8.0	8.0	5.0	0.456	0.456	0.456	0.456
Total/average	100.0	100.0	6.0	8.0	7.8	4.7	0.440	0.440	0.440	0.440
Area:										
N	70		6.0		7.8		0.469	0.469	0.469	0.469
S	30		8.0		4.7		0.374	0.374	0.374	0.374
Total/average	100		6.6		6.7		0.440	0.440	0.440	0.440

Note that in the table we have added a fourth scheme, that is, a forfait-based scheme with two different forfaits: one for settling claims occurred in area N (7.8 euros per claim) and one for area S (4.7 euros). Once we allow for different forfaits in the two areas, we are in fact replicating the results of the previous section for two different nations.[27] In principle, this is simple and clear. In practice, however, there is a caveat, due to the fact that there is no obvious and natural definition of a cluster (region, province, urban, suburban etc.).

A somewhat less intuitive and more interesting result is shown in Table 8.

[27] Implicitely, we have assumed that there are no accidents between residents of different regions. This may be a reasonable semplification of the problem if the two regions are sufficiently large and far apart.

RESULT 10. – *With equal costs across companies in each cluster and different frequencies both across companies and clusters, ECCs are the same in all systems both in the aggregate and for residents in each area. ECCs do instead differ across companies.*

Table 8 – Geography. (Same costs and different frequencies in each area)

	Assumptions						Expected claim costs: euros			
	Market shares (in %)		Freq. of claims (in %)		Average cost per claim (euros)		Standard third party	Direct reimbursement		
								Forfait based		Cost based
								1 forfait	2 forfait	
Company:	N	S	N	S	N	S				
Small	2.0	15.0	6.0	8.0	7.0	4.0	0.344	0.323	0.344	0.346
Medium	15.0	2.0	7.0	9.0	7.0	4.0	0.483	0.490	0.483	0.483
Rest of Market	83.0	83.0	8.0	10.0	7.0	4.0	0.512	0.512	0.512	0.512
Total/average	100.0	100.0	7.8	9.7	7.0	4.0	0.499	0.499	0.499	0.499
Area:										
N	70		7.8		7.0		0.547	0.547	0.547	0.547
S	30		9.7		4.0		0.387	0.387	0.387	0.3887
Total/average	100		8.4		6.0		0.499	0.499	0.499	0.499

The most relevant part of this result is that, under DR schemes, residents in the two areas have the same ECCs per policy as in TP. Residents in the different areas should hence be indifferent to a change from TP to any of the various DR schemes. ECCs of the different companies do instead differ across different schemes. The main thing that can be said in this regard is that, once again, the cost-based system yields smaller differences relative to TP than the forfait-based scheme (with a single forfait): the standard deviation of percent differences is in fact 0.3 in the cost-based scheme against 3.3 in the forfait-based scheme.

In the final step of our analysis, we relax assumption A1 (while maintaining A2) by considering differences in costs that do not depend on companies' efficiency nor on clusters, but, more generally, on the characteristics of the portfolio mix of the different companies.

4.3. Costs linked to the portfolio mix

In the usual context of TP, the cost variable that matters is the value of the damage that a car is likely to inflict on third parties in a collision with responsibility. This is the reason why heavy (or powerful) cars pay higher premiums. In DR schemes instead a key variable is the value of the damage suffered by the policyholder, much like in standard first party insurance.

This distinction is crucial when we compare the different systems, as we do in Tables 9 and 10.

In Table 9, costs differ across companies because of the different values of the damages suffered by their own clients following collisions caused by third parties. For example, company Small has lower costs than Medium because its clients drive cheaper cars. Replacement costs for parts of its clients' cars are hence cheaper. Company R.o.M. has the highest cost. This may be due to the fact that it insures expensive cars or, on the contrary, that it insures cars that are very cheap, but not safe. In this case, it is exposed to higher costs for bodily injuries.

Table 9 – Costs linked to portfolio mix.
(Same frequencies and different costs for collisions caused by third parties to clients of each company)

	Assumptions			Expected claim costs: euros		
	Market shares (in %)	Frequency of claims (in %)	Average cost per claim (*) (euros)	Standard third party	Direct reimbursement	
Company:					Forfait based	Cost based
Small	2.0	8.0	4.0	0.465	0.320	0.320
Medium	15.0	8.0	5.0	0.465	0.400	0.400
Rest of Market	83.0	8.0	6.0	0.465	0.480	0.480
Total/average	100.0	8.0	5.8	0.465	0.465	0.465

(*) Costs incurred by clients of each of the three companies following collisions caused by third parties.

In order to focus on costs differentials and to avoid considering separately Case 1 and Case 2, we let frequencies be the same across companies. We then have the following:

RESULT 11. – *Aggregate ECCs are the same under the three schemes, but, under TP, ECCs of individual companies are invariant with respect to the cost differentials of the collisions suffered by their clients.*

RESULT 12. – *The two DR schemes yield the same results in terms of individual companies' ECCs.*

The fact that, under TP, ECCs are invariant with respect to costs suffered is sometimes considered as an unfair social aspect of the system. An implication is that people driving cheap cars in a wealthy community will pay higher premiums (higher than the premiums they would pay in a less wealthy community), because they are likely to inflict damages on expensive vehicles carrying wealthy drivers and passengers. DR schemes are immune to this problem.

The opposite situation is depicted in Table 10, where costs differ across insurers for the usual reason in TP: different types of cars cause different liabilities to third parties. The results here are symmetric to the ones just described:

RESULT 13. – *Aggregate ECCs are the same under the three schemes, but, under DR schemes, individual companies' ECCs are invariant with respect to the costs of collisions inflicted to third parties.*

Table 10 – Costs linked to portfolio mix.
(Same frequencies and different costs for collisions caused to third parties by clients of each company)

	Assumptions			Expected claim costs: euros		
	Market shares (in %)	Frequency of claims (in %)	Average cost per claim (*) (euros)	Standard third party	Direct reimbursement	
Company:					Forfait based	Cost based
Small	2.0	8.0	4.0	0.320	0.465	0.465
Medium	15.0	8.0	5.0	0.400	0.465	0.465
Rest of Market	83.0	8.0	6.0	0.480	0.465	0.465
Total/average	100.0	8.0	5.8	0.465	0.465	0.465

(*) Costs of collisions caused to third parties by clients of each of the three companies.

In this case, DR schemes have the effect of "flattening" ECCs, and presumably prices, relative to TP. Note however that expensive cars

will continue to pay higher premiums than cheaper cars, since they are exposed to higher losses. Note also that the "flattening" effect is the same in both DR schemes.

Table 10 highlights a problem that may turn out to be rather serious in practice, when a country switches from TP to DR, in either version. As can be seen, the policyholders with the lowest average costs (which in the table happen to be those of company Small) suffer a large increase in tariffs, from 0.320 to 0.465. In the FB scheme, this is due to the fact that the cost of the accidents they cause rises for their company from 4.0 euros to 5.8 euros (i.e. the value of the forfait, which reflects the average costs of all policyholders). An example may be motorcycles. Such vehicles typically cause smaller damages than, much heavier, automobiles. The problem is compounded by the fact that motorcycles suffer larger damages than other types of vehicles when hit by third parties, because of the higher probability of bearing bodily damages. Thus agent companies will receive a forfait from principal companies that is smaller on average than the costs they actually bear in order to handle the claims of their clients who drive motorcycles. Indeed looking back at table 9, one can see that, when switching from TP to DR, ECCs rise for the category of consumers (who happen to be those insured with RoM) who have the highest costs following collisions caused by third parties.

These considerations are rather intuitive. The value added of the simulations is that the problem is not eliminated nor even attenuated in the CB scheme. Pure premiums need not be the same, as in tables 9 and 10, in the two schemes. This depends essentially on the pattern of frequencies. However, different simulations, available on request, show that in general there is no presumption that the increase in EECs for "motorcycle" types of vehicles is smaller under a CB than under a FB scheme.

In a FB scheme, a partial solution to the problem consists again in using two different forfaits for the two different types of vehicles: a forfait for vehicles type "A" and one for vehicles type "M". Not surprisingly,[28] a full solution to the problem (i.e. one that leaves the system with the same structure of ECCs as under TP) consists in adopting not two, but actually four forfaits depending on the type of collision: "A hits A", "M hits M", "A hits M", "M hits A".

[28]This point can be easily seen with a simple two company-two vehicles example.

Proceeding along this logic, since there are many types of vehicles circulating in different geographical clusters, one may end up with a fairly large matrix of forfaits. This may turn out to be rather cumbersome in practice, but does not seem to cause conceptual problems, as long as the forfaits are not made to depend on the monetary value of the accidents. Only in this later case there is an obvious moral hazard problem, because companies may be tempted to calibrate the indemnification to the claimants so as to be reimbursed the highest possible value of the forfait.

4.4. On moral hazard and antitrust policy

As in any relation between a principal and an agent, there may be moral hazard problems between the company that has the final responsibility for a claim and the company that handles the claim.

For example, an agent company could be overly lenient in indemnifying small claims to retain clients and obtain a money surplus at the expense of other companies. An instance of this possibility is depicted in Table 11, where we have assumed that the three companies are identical in terms of all usual variables (size, frequency, efficiency, portfolio mix). The only difference is that company Medium handles additional, small and phony, claims amounting to 20% of the normal claims. Normal claims have an average cost of 5 euros. Fake claims only cost 1 euro. Average costs per claim and the forfait turn out to be equal to 4.8 euros. The results are the following:

Result 14. – *Aggregate ECCs rise (by 0.007) in both schemes relative to TP because the system is handling a larger number of claims. Company Medium reduces its ECCs at the expense of the other companies.*

A natural solution to moral hazard problems is generally given by monitoring activity. In our context, this would require that detailed information on each claim flow from agent to principal companies, so that the latter can check whether some other company is being reimbursed for an anomalously high number of small claims.

Monitoring through exchange of information is also the natural solution to another type of moral hazard problem that may arise in connection with large claims. Here the temptation is to avoid direct reimbursement when the cost of the claim exceeds the value of the

Table 11 – Moral hazard

	Assumptions			Moral hazard		Expected claim costs: euros		
Company:	Market shares (in %)	Freq. of claims (in %)	Average cost per claim (euros)	'Fake' claims	Cost of 'fake' claims (euros)	Standard third party	Direct reimbursement	
							Forfait based	Cost based
Small	33.0	10.0	5.0	0%	–	0.500	0.532	0.529
Medium	33.0	10.0	5.0	20%	1.0	0.500	0.457	0.462
Rest of Market	33.0	10.0	5.0	0%	–	0.500	0.532	0.529
Total/average	100.0	10.0	5.0			0.500	0.507	0.507

forfait. This can be done by offering clients reimbursements that run above the threshold that has been set for the system. As recalled above, in the current Italian scheme, collisions involving serious bodily injuries (permanent disabilities above 9%, as measured by an official disability scale) are excluded from the DR scheme and are handled with the traditional TP scheme by the company of the responsible party[29].

Continuous exchanges of information do take place in the French (FB) non-compulsory scheme. Within the French IRSA convention the principal company is informed in real time about the cost of each settlement incurred by the agent company. In the old Italian (CB) scheme information flows used to occur monthly in step two of the procedure when a company was reimbursed by other companies for the claims it had handled on their behalf.

It has however been argued by the Italian antitrust authority that the availability of such information about competitors' costs may facilitate the coordination of pricing decisions in the market.[30] This is indeed the main reason why in Italy the old CB system was abandoned in favor of a FB type of scheme, which can be run without exchanges of information. Indeed, the current Italian scheme differs from the French one not only because it is compulsory by law, but also because companies cannot exchange information about each other's costs.

Also in light of this prohibition, Italian insurers had to analyze carefully the problem of moral hazard. One of the key conclusions was that moral hazard in connection to small claims is likely to be a

[29]The reason for this exclusion is that serious injuries do not fit a scheme whose viability relies crucially on the law of large numbers.

[30]Autorità per la Concorrenza e il Mercato. Recommendation (2006).

more serious concern with respect to bodily than to material damages. For this reason it was decided to adopt a single forfait for bodily and material damages, in the sense that a claim gives rise to the same forfait regardless of whether it does or does not involve bodily damages. In this way, it is believed that companies retain an incentive to control medical certificates and to check whether a given accident did actually give rise to injuries for the claimants.

4.5. Summing up the results of the simulation

A first set of results concerns the comparison between TP and DR schemes in general.

- The "mechanical effects" of switching from TP to DR are likely to be small in terms of aggregate costs for the industry. "Mechanical effects" are those that emerge when frequencies and costs per claim are held constant in the comparison of the different systems.
- Distributive effects across companies of different size, regions and classes of policyholders do exist, but may become a serious concern for specific segments of the market. Technical solutions can be devised to solve, or at least alleviate the problems.
- DR forces actuaries and managers of companies to focus on different variables than under a TP scheme. The technical and statistical basis necessary to set tariffs borrows elements of the typical first party motor insurance.
- In TP ECCs and therefore prices are independent of the costs associated with collisions *without* responsibility, while in DR schemes ECCs are independent of costs associated with collisions *with* responsibility. In practice, in a standard TP scheme liability insurance for big cars tends to be expensive because big cars cause more serious damages than small cars to third parties. In DR schemes, insurance for big cars will still tend to be more expensive, but for a different reason: they suffer more expensive damages when they are hit.

A second set of results concerns the comparison between forfait and cost-based DR schemes:

- Although these two schemes may appear quite different in their operating mechanisms, they yield very similar results in terms of total costs and their distribution among companies and policyholders.

- Both schemes seem to have desirable properties, as they provide incentives that are very similar to those prevailing in TP to minimize costs, through portfolio selection and operational efficiency.
- It is generally not true that a forfait scheme, for being based on a single parameter for settlements among companies, tends to produce "flatter" tariffs than TP or a cost-based system.
- Flat tariffs, with respect to the frequency factor, may however emerge in a forfait-based scheme if the value of the forfait is set an inappropriately low level. If the forfait is set too low, there is a weakening of the incentive for companies to select careful drivers, through classification and experience rating. Symmetrically, an inappropriately high forfait will tend to increase costs differentials due to different frequencies.
- Under a wide set of circumstances (cost differential depending more on efficiency differential than on the portfolio mix of different insurers), a cost-based DR scheme is likely to produce smaller departures from TP than a forfait-based one. However, in this scheme setting tariffs may be a more difficult task as total costs of a given company depend not only on its frequencies and average costs, but also on its ranking in terms of costs, relative to the other companies participating in the settlement procedure.
- A forfait-based scheme could be modified to yield results closer to those emerging in TP, by fixing different values of the forfait for different geographical areas as well as for different types of vehicles (e.g. trucks, cars, motorbikes etc.) or different types of collisions (motorbikes against cars, cars against motorbikes, cars against cars etc.).

5. Concluding remarks

Direct reimbursement schemes are likely to improve the quality of the loss settlement service and the relationship between insurers and policyholders. In the long run, this fact may have the effect of reducing those extra costs that can be imputed to moral hazard in the insurer-insured relationship. Whether such schemes can reduce costs also in the short run appears to be a more controversial matter.

On one hand, if accompanied by appropriate legislation, contractual provisions and industrial organization, direct reimbursement schemes allow companies to achieve a better control on the complex productive

process that is necessary to settle claims. On the other hand, they may induce them to be more lenient to the claimants, because the latter would become "clients", rather than a "third party", as in a standard third party liability system.

Direct reimbursement is unlikely to produce significant differences relative to the standard third party scheme in terms of the distribution of costs across companies and categories of consumers. Under a wide set of realistic circumstances, they yield essentially the same distribution of costs for companies and consumers as a standard third party scheme.

Forfait and cost based schemes are more similar to each other than it might appear at a superficial analysis. In most circumstances, they yield very similar results for companies and categories of consumers.

Both schemes are exposed to some moral hazard problems in the principal-agent relationship that they imply between the company that handles the claim and the company of the person who bears the (full or partial) responsibility for an accident. Such problems may be fairly serious, but one should not lose the sense of proportion. For instance, they certainly have a smaller impact than the moral hazard problems that often arise in the relation between insures and claimants under third party arrangements.

In any case, remedies can be put in place to try to minimize these problems, for instance by resorting to a single forfait for material and bodily damages. Generally, however, it is difficult to give up the most classic of all remedies to moral hazard problems, that is, monitoring, through detailed exchange of information and peer pressure among companies.

There does not seem to be any valid technical reason for the view that a forfait-based scheme, for hinging on a single parameter for intra-company settlements, tends to cause "flatter" costs, and prices, than a cost-based scheme. It is true however that, in such scheme, tariffs differentials between different categories of consumers may depend on the value of the forfait. Under some circumstances, an inappropriately high (low) value of the forfait tends to cause excessively large (small) differentials with respect to the frequency gradient than it would be socially efficient.

Under some circumstances (e.g. significant regional gaps), the adoption of a single forfait may determine a redistribution of costs among companies and categories of consumers that may be, or may be perceived, as unfair. Pure premiums may turn out to be rather different from those prevailing under standard third party arrangements, a feature

that is undesirable because it is the outcome of the adoption by insurers of a conventional settlement scheme. This problem can be solved by using different forfaits for different geographical locations as well as different types of vehicles or different types of collisions.

A cost based system seems to be more robust with respect to regional gaps than a forfait based system. However in such system setting tariffs is likely to be a more difficult and uncertain task, because a company's costs depend on its ranking relative to the other companies in the market.

In addition, a cost based system is exposed to criticism by the antitrust authorities because it requires detailed exchanges of information from the agent company to the principle company. As we have argued, exchanges of information are useful, in both schemes, in order to minimize the problem of moral hazard that may arise in the relationship between the principal company that ultimately pays for a claim and the agent company that handles the claim of its client. There is hence a trade-off between moral hazard and competition considerations that, as we have seen, has given rise to different solutions in different European countries.

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GIAMPAOLO GALLI – CARLO SAVINO
ANIA
Via della Frezza, 70
00186 Rome, Italy
http:// www.ania.it
giampaolo.galli@ania.it
carlo.savino@ania.it