Understanding the Choice 'Negociation vs. Court' for Bodily Injury Claim Compensations

A. Charpentier (UQAM & Université de Rennes 1)

with E. Betz, P.Y. Geoffard & J. Tomas

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Université Paris Nanterre

DataJust

"This algorithm aims in particular at developing an indicative baseline of compensation for personal injuries. This baseline system will be made available not only to judges, but also to lawyers, insurers and, above all, victims, in order to assess the amount of compensation to which the latter may be entitled, with the aim of encouraging out-of-court settlements." Soulier (2020)

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Avec DataJust, les algorithmes de la justice inquiètent

Analyse Le Conseil d'État a rejeté plusieurs recours contre le projet DataJust du ministère de la justice. Avec cet algorithme, le ministère souhaite fournir un « référentiel indicatif » pour les indemnisations liées à des dommages corporels. Associations de victimes et de défenses des libertés numériques dénoncent un projet disproportionné.

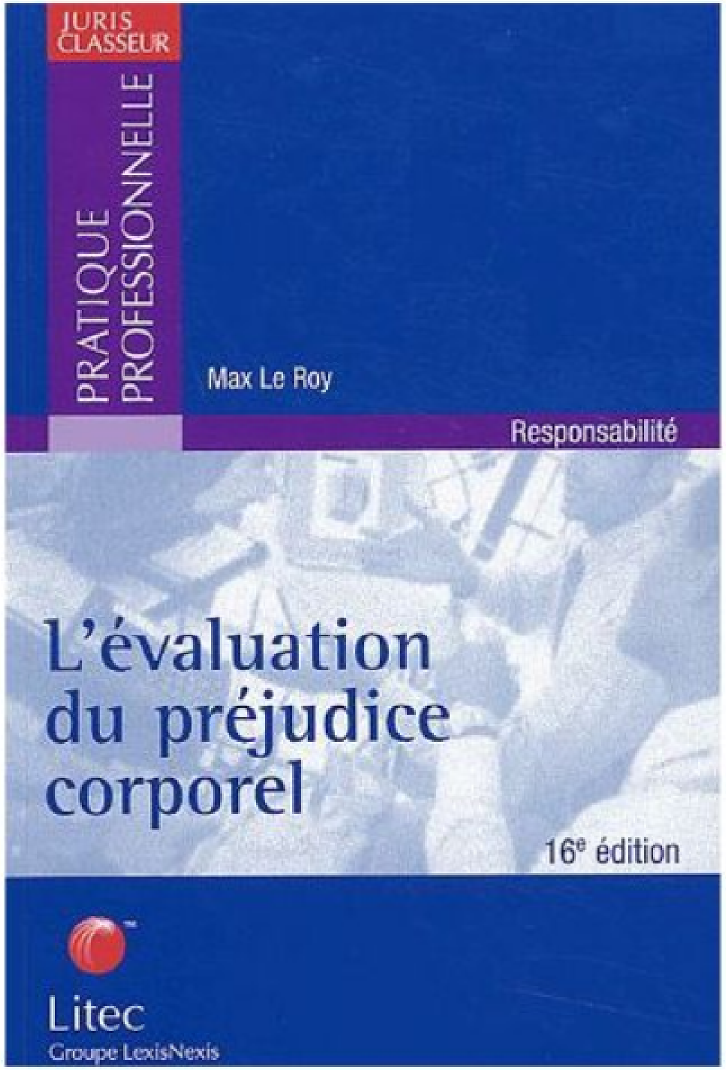
Audrey Dufour, le 07/01/2022 à 15:15 Modifié le 07/01/2022 à 18:26

Dans ce dossier

Justice

Au procès des attentats du 13 novembre, Salah Abdeslam nie avoir convoyé les terroristes

Bodily Injury Claims (an introduction to the introduction)



Annexes I et II

VALEUR DE L'EURO DE RENTE

Les valeurs de l'euro données dans ce barème ont été calculées en utilisant les tables de mortalité TV 88-90 et TD 88-90 sur la base d'un taux de capitalisation de 5 %.

Notre choix de ce taux de capitalisation est fondé sur une analyse historique et prévisionnelle du taux des emprunts d'État à long terme en France.

Les tables de conversion ont été établies par Monsieur Charpentier, professeur assistant en finance et actuariat à l'École nationale de la statistique et de l'administration économique (ENSAE), professeur assistant en statistique et finance à l'École nationale de la statistique et de l'analyse de l'information (ENSAI) et co-auteur de l'ouvrage *Mathématiques de l'Assurance Non-Vie* (Économica).

Barème de capitalisation de rentes
Sexe masculin

Âge	Prix de mille euros de rente viagère	Prix de mille euros de rente temporaire limitée à :						
		65 ans	60 ans	55 ans	25 ans	20 ans	18 ans	16 ans
0	18 953	18 653	18 472	18 223	13 915	12 318	11 558	10 719
1	19 075	18 757	18 556	18 302	13 739	12 048	11 243	10 354
2	19 043	18 710	18 509	18 231	13 436	12 051	10 814	9 879
3	19 005	18 654	18 443	18 152	13 115	11 660	10 360	9 378
4	18 962	18 594	18 372	18 066	12 775	11 247	9 881	8 850
5	18 916	18 529	18 296	17 975	12 418	10 813	9 379	8 296
6	18 867	18 461	18 216	17 879	12 042	10 357	8 850	7 713
7	18 815	18 389	18 132	17 777	11 648	9 877	8 295	7 100
8	18 760	18 312	18 042	17 670	11 233	9 373	7 712	6 457
9	18 703	18 232	17 949	17 558	10 797	8 844	7 099	5 781
10	18 642	18 147	17 850	17 439	10 339	8 288	6 455	5 072
11	18 578	18 059	17 746	17 315	9 858	7 704	5 779	4 326
12	18 511	17 966	17 638	17 185	9 353	7 091	5 070	3 544
13	18 441	17 868	17 524	17 048	8 823	5 775	4 324	2 722
14	18 368	17 767	17 405	16 905	8 267	5 065	3 542	1 858
15	18 293	17 661	17 281	16 756	7 683	4 320	2 720	952
16	18 216	17 553	17 153	16 602	7 071	3 538	1 857	
17	18 139	17 442	17 022	16 443	6 429	2 718	952	
18	18 062	17 330	16 889	16 280	5 756	1 856		
19	17 987	17 217	16 754	16 114	5 051	951		
20	17 912	17 102	16 615	15 942	4 310			
21	17 834	16 953	16 470	15 763	3 532			
22	17 754	16 859	16 320	15 576	2 715			
23	17 672	16 730	16 164	15 381	1 855			
24	17 585	16 594	15 998	15 176	951			
25	17 493	16 452	15 825	14 959				
26	17 396	16 301	15 642	14 732				
27	17 294	16 143	15 449	14 492				
28	17 187	15 976	15 247	14 241				
29	17 075	15 802	15 035	13 977				
30	16 958	15 619	14 812	13 699				

Bodily Injuries from a Legal (and Economic) Perspective

Calabresi (1961 , 1965) "*it is motorists, not pedestrians, should bear the cost of accidents*" : non-fault liability

Sugarman (2010) compared "no-fault law" in many countries (several states in the United States since 1972, in New Zealand since 1974, and in France since 1985).

Theoretical and empirical investigation of the effect of "no-fault law" Landes (1982).

Impact of tort reforms Browne & Schmit (2008) related to automobile bodily injury claims.

Process of negotiation with the insurer Cauchard (1989) or Browne & Puelz (1999)

Court issues Santolino, M. (2010) on appeals for automobile bodily injury claims.

Loi Badinter, 1985

7584 JOURNAL OFFICIEL DE LA RÉPUBLIQUE FRANÇAISE 6 juillet 1985

LOI n° 85-677 du 5 juillet 1985 tendant à l'amélioration de la situation des victimes d'accidents de la circulation et à l'accélération des procédures d'indemnisation (1)

L'Assemblée nationale et le Sénat ont adopté,

Le Président de la République promulgue la loi dont la teneur suit :

CHAPITRE I^er^

Indemnisation des victimes d'accidents de la circulation

Art. 1^er^. – Les dispositions du présent chapitre s'appliquent, même lorsqu'elles sont transportées en vertu d'un contrat, aux victimes d'un accident de la circulation dans lequel est impliqué un véhicule terrestre à moteur ainsi que ses remorques ou semi-remorques, à l'exception des chemins de fer et des tramways circulant sur des voies qui leur sont propres.

Section I

Dispositions relatives au droit à indemnisation

Art. 2. – Les victimes, y compris les conducteurs, ne peuvent se voir opposer la force majeure ou le fait d'un tiers par le conducteur ou le gardien d'un véhicule men-

terrestre à moteur, ainsi que par ses remorques ou semi-remorques, » sont remplacés par les mots : « en raison de dommages subis par des tiers résultant d'atteintes aux personnes ou aux biens dans la réalisation desquels un véhicule terrestre à moteur, ainsi que ses remorques ou semi-remorques, est impliqué, ».

Art. 8. – Le deuxième alinéa de l'article L. 211-1 du code des assurances est remplacé par les dispositions suivantes :

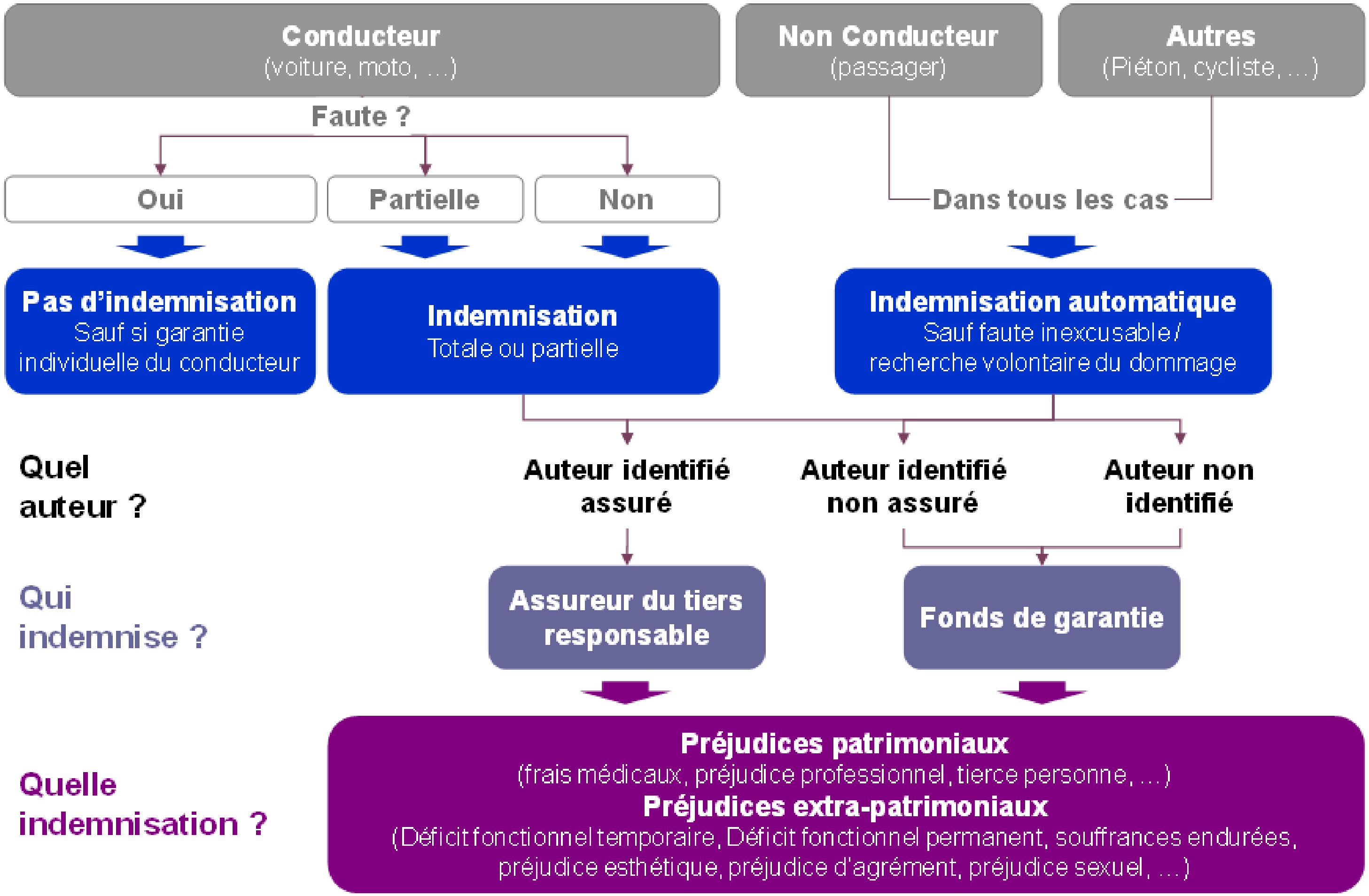
« Les contrats d'assurance couvrant la responsabilité mentionnée au premier alinéa du présent article doivent également couvrir la responsabilité civile de toute personne ayant la garde ou la conduite, même non autorisée, du véhicule, à l'exception des professionnels de la réparation, de la vente et du contrôle de l'automobile, ainsi que la responsabilité civile des passagers du véhicule objet de l'assurance.

« L'assureur est subrogé dans les droits que possède le créancier de l'indemnité contre la personne responsable de l'accident lorsque la garde ou la conduite du véhicule a été obtenue contre le gré du propriétaire.

« Ces contrats doivent être souscrits auprès d'une entreprise d'assurance agréée pour pratiquer les opérations d'assurance contre les accidents résultant de l'emploi de véhicules automobiles. »

Art. 9. – L'article L. 420-1 du code des assurances est ainsi rédigé :

Loi Badinter, 1985



Source : http://www.association-accicorps.fr/

Compensation

Compensation should cover health expenditure (medical costs, hospitalisation, etc.) up to healing or recovery. Additional compensation can be paid for temporary incapacity (*incapacité temporaire*, denoted I.T.), loss of professional earnings (*pertes de gains professionnels actuels*, dented PGPA) or temporary functional deficit (*déficit fonctionnel temporaire*, denoted D.F.T.).

Compensation can also be related to permanent incapacity, partial or total (*incapacité permanente partielle ou totale*, denoted I.P.P.) or permanent functional deficit (*déficit fonctionnel permanent*, or D.F.P.).

Finally, miscellaneous costs can also been asked for pain and suffering damage (*pretium doloris*), or for disfiguration damage. Those two are measured on a 1 to 7 scale.

Compensation

I. PREJUDICES DE LA VICTIME DIRECTE

I – Préjudices économiques (pertes de revenus, gains manqués, frais exposés…)

1° Préjudices économiques temporaires (avant consolidation des blessures)

DS Dépenses de santé actuelles (médicale, hospitalière, paramédicale, pharmaceutique…)

FD Frais divers : honoraires des conseil (avocat, médecin) de la victime et autres frais (transport, garde d'enfant…).

IPT Incidence professionnelle temporaire

RP Reclassement professionnel et frais de formation.

2° Préjudices économiques permanents (après consolidation des blessures)

FF Frais futurs : dépenses de santé futures (frais prévisibles et répétitifs : prothèse, appareillage…)

FLA Frais de logement adapté

FVA Frais de véhicule adapté

TP Tierce personne (aide dans les démarches quotidiennes)

IPF Incidence professionnelle définitive (pertes de gains professionnels, dévalorisation sur le marché du travail, pénibilité à l'emploi)

II – Préjudices personnels

1° Préjudices personnels temporaires (avant consolidation des blessures)

PFT Préjudice fonctionnel temporaire (perte de qualité de vie et troubles dans les conditions d'existence, dégagés de toute incidence professionnelle, ayant un caractère temporaire)

SE Souffrances endurées (physiques et psychiques)

2° Préjudices personnel permanents (après consolidation des blessures)

PFP Préjudice fonctionnel permanent (perte de qualité de vie et troubles dans les conditions d'existence, dégagés de toute incidence professionnelle, ayant un caractère définitif)

PAS Préjudice d'agrément spécifique (ex : incapacité à continuer la pratique d'un sport)

PE Préjudice esthétique.

PS Préjudice sexuel et d'impossibilité de procréation.

PET Préjudice d'établissement (adaptations aux nouvelles conditions d'existence)

II. PREJUDICES DES VICTIMES INDIRECTES

(= proches du défunt)

I – Préjudices économiques

Frais d'obsèques et de sépulture
Autres frais (transport, hôtel…)
Perte de revenus

II – Préjudices personnels

Préjudice d'accompagnement (bouleversement dans les conditions d'existence)
Préjudice d'affection.

The Dataset(s)

The dataset provided by Association pour la Gestion des Informations sur le Risque Automobile, AGIRA (cf http://victimesindemnisees-fvi.fr)

FICHIER DES INDEMNITES ALLOUEES

AUX VICTIMES D'ACCIDENTS DE LA CIRCULATION

(F.V.I.)

1 – Les objectifs poursuivis

Créé en 1988 en collaboration avec les Pouvoirs Publics, le fichier FVI a été mis en place pour répondre aux obligations résultant de l'article 26 de la loi du 5 juillet 1985 (loi Badinter).

Ce texte fait obligation aux assureurs et aux magistrats de communiquer les montants des indemnisations versées pour des dommages corporels survenus lors d'accidents automobiles.

L'objectif poursuivi est de permettre à toute victime ou à ses représentants, de connaître les montants des indemnités auxquels elle pourrait prétendre. La publication des décisions doit en outre contribuer à limiter les écarts constatés entre différentes Cours d'Appel pour des situations comparables.

The Dataset(s)

3 – Accès au fichier

Il peut être consulté librement par Minitel : 3615 AGIRA. En 2002, 1.850 interrogations en moyenne par mois ont été enregistrées (contre 1.600 en 1999).

Les critères de recherche permettent de sélectionner la liste des cas enregistrés selon le type de décision - transaction ou décision judiciaire -, l'âge, le sexe, le taux d'incapacité permanente et le département.

19.477 cas (dont 745 cas de décès) ont été transmis pour le compte de l'exercice 2001.

See also Serverin *et al.* (1997) Victims had an accident between January 1st 1997 and December 31st 2014, settled before March 2017.

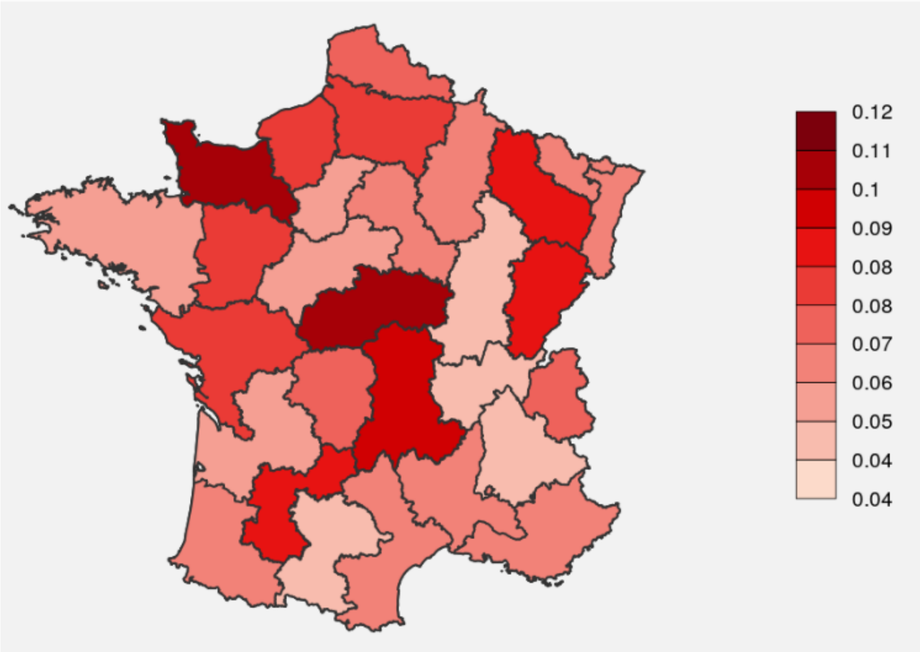
	number total	average indemnity	Q10 indemnity	Q50 indemnity	Q90 indemnity	Q95 indemnity	Q99 indemnity
Negociation	344,424	19,502	2,700	6,945	33,127	58,235	200,886
Judicial	20,405	88,396	5,327	23,936	164,721	313,038	1,101,831
(incl. Appeal)	2,333	215,739	10,217	69,240	426,089	798,263	2,857,196

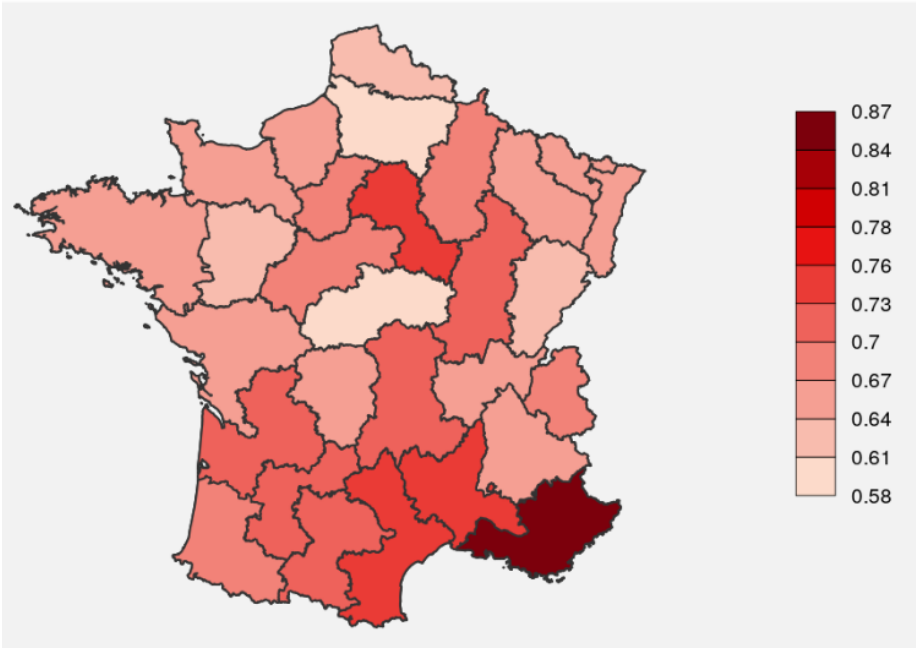
	number total	number Negociation	number Judicial	(inc Appeal)	number Male	number Female	average Age[1]
1997	12,822	10,967	1,855	234	6,452	6,370	40.265
1998	23,702	21,751	1,951	198	11,158	12,544	42.999
1999	21,427	19,611	1,816	228	10,048	11,379	43.604
2000	14,904	13,270	1,634	227	7,196	7,708	43.473
2001	14,951	13,248	1,703	253	7,423	7,528	42.879
2002	17,852	16,358	1,494	226	8,620	9,232	43.352
2003	16,977	15,761	1,216	184	8,145	8,832	43.581
2004	17,865	16,669	1,196	170	8,255	9,610	43.956
2005	18,471	17,224	1,247	156	8,251	10,220	44.268
2006	18,501	17,266	1,235	124	7,946	10,555	44.276
2007	22,234	20,952	1,282	105	9,071	13,163	44.338
2008	24,762	23,608	1,154	86	9,667	15,095	45.457
2009	21,815	20,930	885	77	8,061	13,754	45.862
2010	24,481	23,891	590	30	10,274	14,207	44.773
2011	24,146	23,611	535	19	10,324	13,822	44.741
2012	24,042	23,688	354	13	10,192	13,850	44.615
2013	23,459	23,269	190	3	9,786	13,673	44.860
2014	22,418	22,350	68	0	9,445	12,973	44.856
total	364,829	344,424	20,405	2,333	160,314	204,515	44.167

	number Driver	number Passenger	number Biker	number Pedestrian	number IPP[3] [0-5)	number IPP [5-15]	number IPP (15,100]
1997	6,176	1,915	324	1,234	6,571	4,981	1,270
1998	11,629	2,982	543	1,991	14,861	7,443	1,398
1999	10,464	2,845	573	2,131	13,842	6,383	1,202
2000	7,093	2,573	532	2,058	8,990	4,809	1,105
2001	7,249	2,923	574	2,262	8,788	4,984	1,179
2002	8,742	3,531	644	2,505	11,445	5,249	1,158
2003	8,155	3,241	721	2,442	11,127	4,837	1,013
2004	8,179	3,088	754	2,604	11,713	5,181	971
2005	7,548	2,855	781	2,680	12,030	5,401	1,040
2006	6,099	2,292	737	2,573	12,088	5,408	1,005
2007	5,298	2,068	783	2,828	14,872	6,392	970
2008	4,263	1,758	956	3,201	17,727	6,223	812
2009	3,364	1,524	1,043	3,090	15,970	5,190	655
2010	1,686	1,162	762	2,271	19,537	4,468	476
2011	1,589	1,095	790	2,239	19,516	4,157	473
2012	1,350	1,026	771	2,034	20,011	3,733	298
2013	1,093	856	656	1,708	20,001	3,247	211
2014	980	823	535	1,302	19,731	2,568	119
total	100,957	38,557	12,479	41,153	258,820	90,654	15,355

	Aix Marseille	Paris	Lyon	Rennes	Toulouse	Bordeaux	Versailles	Montpellier
1997	967	779	357	490	307	302	229	182
1998	1,859	1,180	612	852	511	592	402	420
1999	2,098	1,257	681	896	604	659	438	522
2000	1,925	1,407	709	858	562	599	463	428
2001	2,297	1,768	921	959	657	650	482	466
2002	3,098	2,295	1,064	998	820	751	598	574
2003	3,158	2,117	961	968	766	768	614	582
2004	3,342	2,313	949	1,028	803	722	659	587
2005	3,529	2,337	1,001	1,118	798	677	644	693
2006	3,631	2,491	1,050	1,040	861	707	727	645
2007	4,861	2,886	1,333	1,017	984	850	907	714
2008	5,571	3,020	1,471	1,098	1,089	941	1,119	909
2009	4,949	2,528	1,336	1,077	875	868	874	813
2010	5,946	2,440	1,444	1,244	1,172	1,036	1,007	873
2011	5,923	2,436	1,400	1,228	1,154	986	967	824
2012	6,087	2,388	1,304	1,245	1,111	1,018	977	840
2013	5,997	2,327	1,259	1,232	1,074	933	973	895
2014	5,759	2,142	1,210	1,230	994	905	941	791
total	70,997	38,111	19,062	18,578	15,142	13,964	13,021	11,758

Which Court ? Criminal or Civil ?





	number total	average length	median length	average indemnity	median indemnity
Negotiation	381,377	366 days	246 days	21,101	7,101
Judicial (first)	22,923	876 days	702 days	79,880	25,962
Judicial (appeal)	3,958	1,561 days	1,409 days	198,162	75,545
Judicial (civil)	19,642	971 days	776 days	88,186	26,549
Judicial (criminal)	7,182	992 days	757 days	121,322	45,519

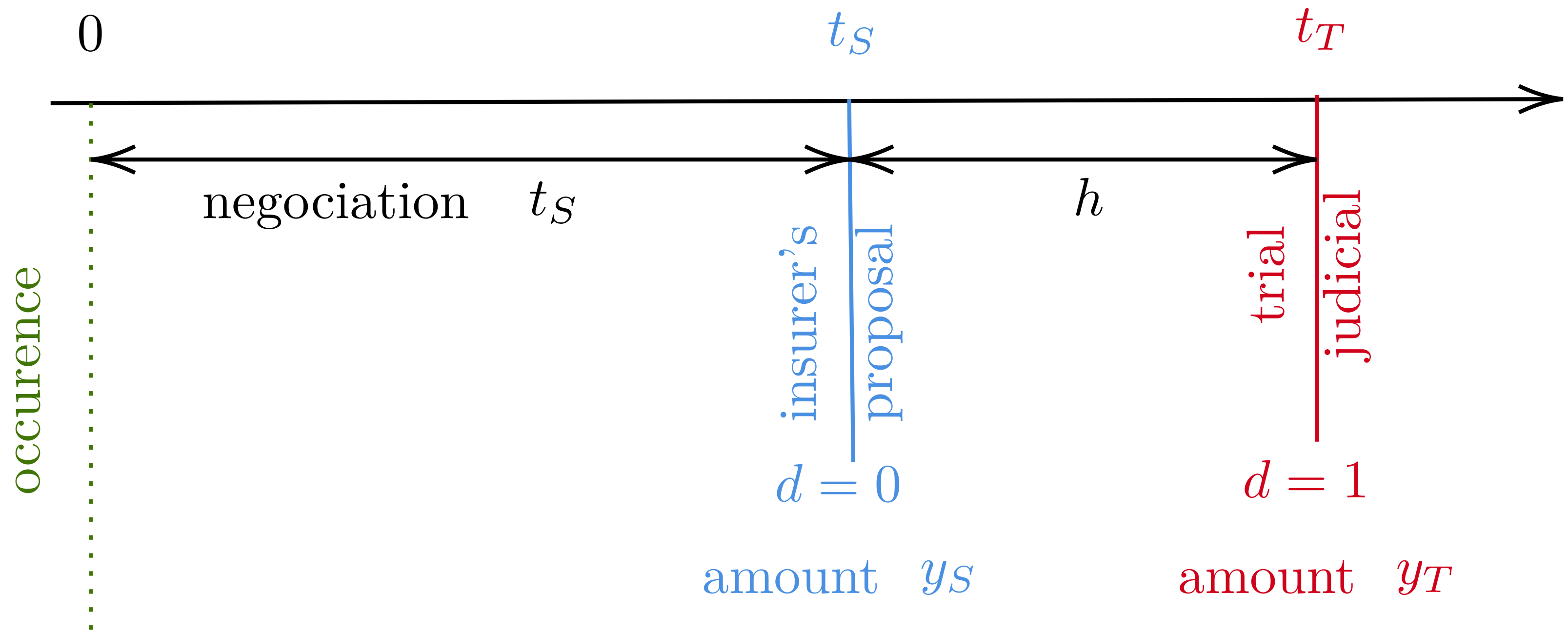
What are we looking for ?

L'objectif poursuivi est de permettre à toute victime ou à ses représentants, de connaître les montants des indemnités auxquels elle pourrait prétendre. La publication des décisions doit en outre contribuer à limiter les écarts constatés entre différentes Cours d'Appel pour des situations comparables.

Is the indemnity obtained in court in Rennes and Aix-en-Provence (*ceteris paribus*) identical ?

Is there is geographical difference in the decision to go to court ?

Econometric Model

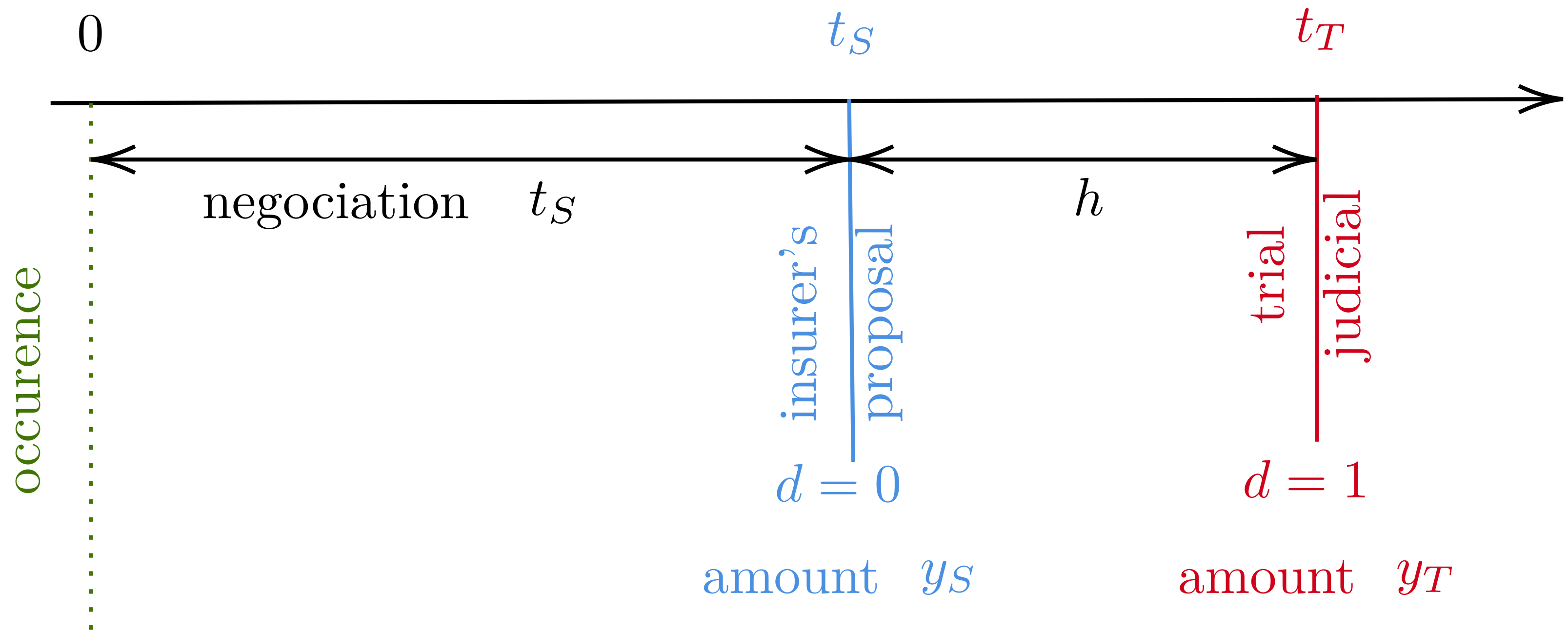


- amount models (limited dependent)

$$\begin{cases} \text{neogiated settlement} & : \log(y_S) = \lambda_{S0} + \boldsymbol{\lambda}_{S1}^\top \boldsymbol{x} + \boldsymbol{\omega}_S + \varepsilon_S \\ \text{trial} & : \log(y_T) = \lambda_{T0} + \boldsymbol{\lambda}_{T1}^\top \boldsymbol{x} + \boldsymbol{\omega}_T + \varepsilon_T \end{cases}$$

$y = y_S$ if $d = 0$, or $y = y_T$ (limited dependent variables, as in Madalla (1983))

Econometric Model



- procedure length models (limited dependent)

$$\begin{cases} \text{neogiated settlement} & : \log(t_S) = \beta_{S0} + \boldsymbol{\beta}_{S1}^\top \boldsymbol{x} + \boldsymbol{\delta}_S + \nu_S \\ \text{trial} & : h = \log(t_S) - \log(t_T) = \beta_{T0} + \boldsymbol{\beta}_{T1}^\top \boldsymbol{x} + \boldsymbol{\delta}_T + \nu_T \end{cases}$$

$t = t_S$ if $d = 0$, or $t = t_T$ (limited dependent variables, as in Madalla (1983))

Econometric Model

- decision model

Agents have CARA (exponential) utility, $v(y) = -\exp(-\rho y)$, with $\rho > 0$, thus, if Y is Gaussian,

$$\mathbb{E}\big[v(Y)\big] = v\left(\mathbb{E}[Y] - \frac{\rho}{2}\text{Var}[Y]\right)$$

With intertemporally separables preferences and a rate δ for time preference, victims go to court (time t) if

$$\exp(-\delta(T-S))\left[\mathbb{E}[Y_T] - \frac{\rho}{2}\text{Var}[Y_T]\right] > Y_S$$

Arrondel & Masson (2005) defined four individuals types :

- *Hotheads* (low ρ, high δ),
- *Short-sighted prudent* (high ρ, high δ),
- *Entreprising* (low ρ, low δ),
- *Armchairs investitor* (high ρ, low δ),

Econometric Model

- decision model

Thus, $d = \mathbf{1}(Z > 0)$ where

$$\begin{cases} Z &= \theta_0 + \theta_1 h + \theta_2 \log(t_S) + \theta_3 \big[\log(y_T) - \log(y_S) \big] + \boldsymbol{\theta}_4^\top \boldsymbol{x} + u \\ Z &= \tilde{\theta}_0 + \tilde{\boldsymbol{\theta}}_1^\top \boldsymbol{x} + \tilde{u} = \boldsymbol{\Psi} + \tilde{u} \end{cases}$$

Assume that $(\varepsilon_S, \varepsilon_T, \nu_S, \nu_T)$ are Gaussian, given $\tilde{u}$

$$\mathbb{E}\left[\varepsilon_S \mid d = 0\right] = \mathbb{E}\left[\varepsilon_S \mid \Psi > \tilde{u}\right] = \sigma_{\varepsilon_S \tilde{u}} \left(\frac{-\phi(\Psi)}{\Phi(\Psi)} \right) = \sigma_{\varepsilon_S \tilde{u}} \pi_S$$

$$\mathbb{E}\left[\varepsilon_T \mid d = 1\right] = \mathbb{E}\left[\varepsilon_T \mid \Psi \leq \tilde{u}\right] = \sigma_{\varepsilon_T \tilde{u}} \left(\frac{\phi(\Psi)}{1 - \Phi(\Psi)} \right) = \sigma_{\varepsilon_T \tilde{u}} \pi_T,$$

$$\mathbb{E}\left[\nu_S \mid d = 0\right] = \mathbb{E}\left[\nu_S \mid \Psi > \tilde{u}\right] = \sigma_{\nu_S \tilde{u}} \left(\frac{-\phi(\Psi)}{\Phi(\Psi)} \right) = \sigma_{\nu_S \tilde{u}} \pi_S$$

$$\mathbb{E}\left[\nu_T \mid d = 1\right] = \mathbb{E}\left[\nu_T \mid \Psi \leq \tilde{u}\right] = \sigma_{\nu_T \tilde{u}} \left(\frac{\phi(\Psi)}{1 - \Phi(\Psi)} \right) = \sigma_{\nu_T \tilde{u}} \pi_T$$

Econometric Model

where π_S and π_T are inverse-Mills ratio,

$$\pi_S = \frac{-\phi(\Psi)}{\Phi(\Psi)} \text{ and } \pi_T = \frac{\phi(\Psi)}{1-\Phi(\Psi)}$$

Thus, using the appropriate sample,

$$\begin{aligned}
\log(y_S) &= \lambda_{S_0} + \boldsymbol{\lambda}_{S_1}^\top \boldsymbol{x} + \boldsymbol{\omega_S} + \sigma_{\varepsilon_S \tilde{u}} \pi_S + \eta_S && \text{if } d=0 \\
\log(y_T) &= \lambda_{T_0} + \boldsymbol{\lambda}_{\boldsymbol{T}_1}^\top \boldsymbol{x} + \boldsymbol{\omega_T} + \sigma_{\varepsilon_T \tilde{u}} \pi_T + \eta_T && \text{if } d=1 \\
\log(t_S) &= \beta_{S_0} + \boldsymbol{\beta}_{S_1}^\top \boldsymbol{x} + \boldsymbol{\delta}_S + \sigma_{\nu_T \tilde{u}} \pi_S + \upsilon_S && \text{if } d=0 \\
h &= \beta_{T_0} + \boldsymbol{\beta}_{\boldsymbol{T_1}}^\top \boldsymbol{x} + \boldsymbol{\delta_T} + \sigma_{\nu_S \tilde{u}} \pi_T + \upsilon_T && \text{if } d=1
\end{aligned}$$

with $\mathbb{E}(\eta_S \mid d=0) = \mathbb{E}(\eta_T \mid d=1) = \mathbb{E}(\upsilon_S \mid d=0) = \mathbb{E}(\upsilon_T \mid d=1) = 0$

Econometric Model

Assume that $\boldsymbol{\xi} = (\xi_S, \xi_T)$ given ϵ^* has a joint Gaussian distribution,

$$\begin{pmatrix} \xi_S \\ \xi_T \end{pmatrix} \Big| \epsilon^* \sim \mathcal{N}\left(\begin{pmatrix} \rho_{S\epsilon^*}\epsilon^* \\ \rho_{T\epsilon^*}\epsilon^* \end{pmatrix}, \begin{pmatrix} \sqrt{\sigma_S^2 - \rho_{S\epsilon^*}^2} & \rho_{ST|\epsilon^*} \\ \rho_{ST|\epsilon^*} & \sqrt{\sigma_T^2 - \rho_{T\epsilon^*}^2} \end{pmatrix}\right),$$

Thus, we recognizee some inverse-Mills ratio

$$\mathbb{E}[\xi_S|\text{Trial} = 0] = \mathbb{E}[\xi_S|\Psi + \epsilon^* < 0] = \sigma_{\xi_1\epsilon^*}\mathbb{E}[\epsilon^*|\epsilon^* \leq -\Psi]$$

$$\mathbb{E}[\xi_S|\text{Trial} = 0] = \sigma_{S\epsilon^*}\left(\frac{-\phi(\Psi)}{1 - \Phi(\Psi)}\right) = \sigma_{S\epsilon^*}\pi_S$$

and

$$\mathbb{E}[\xi_T|\text{Trial} = 1] = \mathbb{E}[\xi_T|\Psi + \epsilon^* > 0] = \mathbb{E}[\sigma_{\xi_T\epsilon^*}\epsilon^*|\Psi \leq \epsilon^*] = \sigma_{T\epsilon^*}\left(\frac{\phi(\Psi)}{\Phi(\Psi)}\right) = \sigma_{T\epsilon^*}\pi_T$$

Econometric Model

For inference, observe, that, if $\widehat{\zeta}_{y_S,i} = \log\left(\widehat{y}_{S,i}\right) - \log\left(y_{S,i}\right)$,

$$\widehat{\sigma}^2_{\varepsilon_S} = \frac{1}{n_S}\sum_{i\in I_S}\left(\widehat{\zeta}_{S,i} - \widehat{\sigma}^2_{\varepsilon_S\tilde{u}}\widehat{\Psi}_i\widehat{\pi}_{S,i}\right)$$

or, since $\mathbb{E}\left[\eta_S^2 \mid d_i = 0\right] = \sigma^2_{\varepsilon_S\tilde{u}}\Psi_i\pi_{S,i} + \sigma^2_{y_S} - \sigma^2_{\varepsilon_S\tilde{u}}\pi^2_{S,i}$

$$\tilde{\sigma}^2_{\varepsilon_S} = \frac{1}{n_S}\sum_{i\in I_S}\left(\widehat{\eta}^2_S - \widehat{\sigma}^2_{\varepsilon_S\tilde{u}}\widehat{\Psi}_i\widehat{\pi}_{S,i} + \widehat{\sigma}^2_{\varepsilon_S}\widehat{\pi}^2_{S,i}\right)$$

This is the structural probit method, as defined in Lee (1979) (a two-stage method).

Econometric Model

See Robinson & Tomes (1984) on union/non-union wage differentials,

unionized sector. The worker joins the union if

$$(1)\qquad \frac{W_{U_i} - W_{N_i}}{W_{N_i}} > \rho_i$$

where W_{U_i} and W_{N_i} are the wage rates that worker i receives in the union and nonunion sectors, respectively. The reservation wage, ρ_i, combines both the monetary costs of unionization implicitly or explicitly borne

(...)

$$(2)\qquad \frac{W_{U_i} - W_{N_i}}{W_{N_i}} \simeq (\ln W_{U_i} - \ln W_{N_i}) > X_i\beta + \varepsilon_i$$

Econometric Model

See also Robinson & Tomes (1984), Willis & Rosen (1979) in the context of education choice, and Kostiuk (1990) used it to model labor choice (shift work vs. regular daytime)

These ideas can be made operational in the following manner. Let W_{Si} be the wage for worker i if he or she is employed on shift work and W_{Di} be the wage for a regular daytime schedule. An individual chooses shift work if

$$\frac{W_{Si} - W_{Di}}{W_{Di}} > \rho_i, \tag{1}$$

where ρ_i can be interpreted as the reservation wage for shift work.[4]

$$\log W_{Si} = X_{Si}\beta_S + \sigma_{S\eta} \frac{\phi(\mathbf{X}_i\hat{\pi})}{\Phi(\mathbf{X}_i\hat{\pi})} \tag{8}$$

and

$$\log W_{Di} = X_{Di}\beta_D + \sigma_{D\eta} \frac{-\phi(\mathbf{X}_i\hat{\pi})}{1 - \Phi(\mathbf{X}_i\hat{\pi})}. \tag{9}$$

Econometric Model Strategy

Step 1: Fit a probit model and estimate Ψ's. Set

$$\widehat{\pi}_{S,i} = \frac{-\phi(\widehat{\Psi}_i)}{\Phi(\widehat{\Psi}_i)} \text{ and } \widehat{\pi}_{T,i} = \frac{\phi(\widehat{\Psi}_i)}{1-\Phi(\widehat{\Psi}_i)} \text{ where } \widehat{\Psi}_i = \widehat{\mu}_0 + \widehat{\boldsymbol{\mu}}_1 \boldsymbol{x}_i + \widehat{\boldsymbol{\mu}}_2 \boldsymbol{z}_i$$

Step 2: fit models for lengths and amounts, and get predictions

$$\log(\widehat{y}_{Si}) = \widehat{\lambda}_{S_0} + \widehat{\boldsymbol{\lambda}}_{S_1}^\top \boldsymbol{x}_i + \widehat{\boldsymbol{\omega}}_{\boldsymbol{S}} + \widehat{\sigma}_{\varepsilon_S \tilde{u}} \widehat{\pi}_{Si} \quad \forall i$$

$$\log(\widehat{y}_{Ti}) = \widehat{\lambda}_{T_0} + \widehat{\boldsymbol{\lambda}}_{T_1}^\top \boldsymbol{x}_i + \widehat{\boldsymbol{\omega}}_{\boldsymbol{T}} + \widehat{\sigma}_{\varepsilon_T \tilde{u}} \widehat{\pi}_{Ti} \quad \forall i$$

$$\log(\widehat{t}_{Si}) = \widehat{\beta}_{S_0} + \widehat{\boldsymbol{\beta}}_{S_1}^\top \boldsymbol{x}_i + \widehat{\boldsymbol{\delta}}_{S} + \widehat{\sigma}_{\nu_T \tilde{u}} \widehat{\pi}_{Si} \quad \forall i$$

$$\widehat{h}_i = \widehat{\beta}_{T_0} + \widehat{\boldsymbol{\beta}}_{\boldsymbol{T_1}}^\top \boldsymbol{x}_i + \widehat{\boldsymbol{\delta}}_{\boldsymbol{T}} + \widehat{\sigma}_{\nu_S \tilde{u}} \widehat{\pi}_{Ti} \quad \forall i$$

Step 3: plug in (logistic model)

$$Z = \theta_0 + \theta_1 \widehat{h} + \theta_2 \log(\widehat{t}_S) + \theta_3 \big[\log(\widehat{y}_T) - \log(\widehat{y}_S)\big] + \boldsymbol{\theta}_4^\top \boldsymbol{x} + u$$

Smoothing Continuous Covariates

Use of b-spline GAMs, e.g. for Equation (**??**)

$$\log[Y_S] = \theta_{S0} + s(X_1) + \boldsymbol{\theta}_{S1(1)}^\top \boldsymbol{X}_{(1)} + \boldsymbol{\delta}_{S2}^\top \boldsymbol{Z} + \xi_S \tag{2-GAM}$$

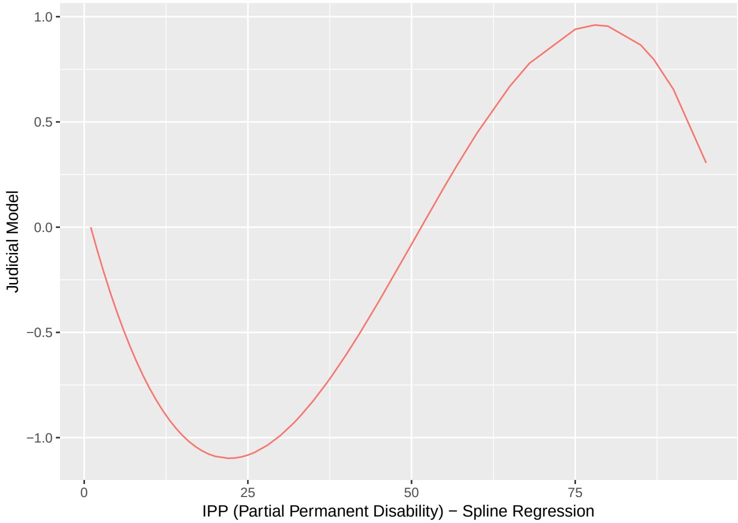
or simply a continuous piecewise linear version

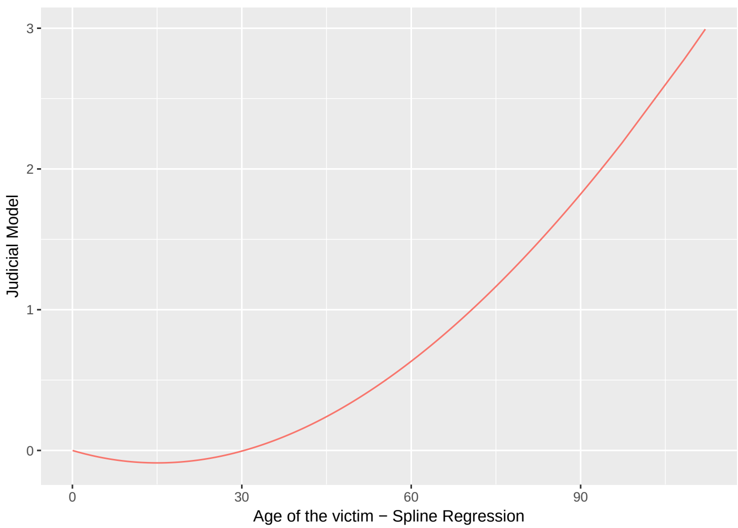
$$\log[Y_S] = \theta_{S0} + \underbrace{\theta_{S1,1}(X_1 - x_1)_+ \cdots + \theta_{S1,k}(X_1 - x_k)_+}_{\text{piecewise linear transformation of } X_1} + \boldsymbol{\theta}_{S1(1)}^\top \boldsymbol{X}_{(1)} + \boldsymbol{\delta}_{S2}^\top \boldsymbol{Z} + \xi_S \tag{2-PWL}$$

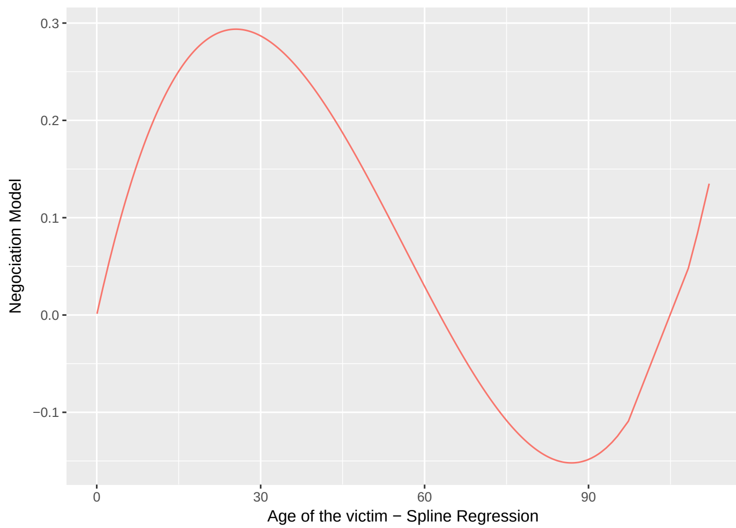
for some (fixed) knots $\{x_1, \cdots, x_k\}$. E.g. for IPP

$$\theta_{S2,1} X_2 + \theta_{S2,2}(X_2 - 25)_+ + \theta_{S2,3}(X_2 - 80)_+ .$$

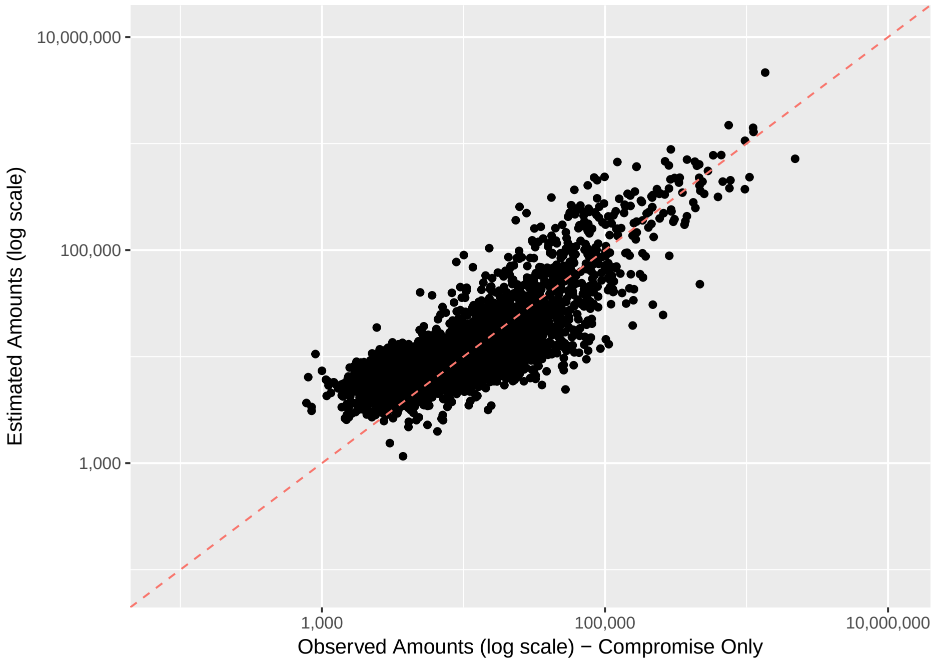
Smoothing Continuous Covariates

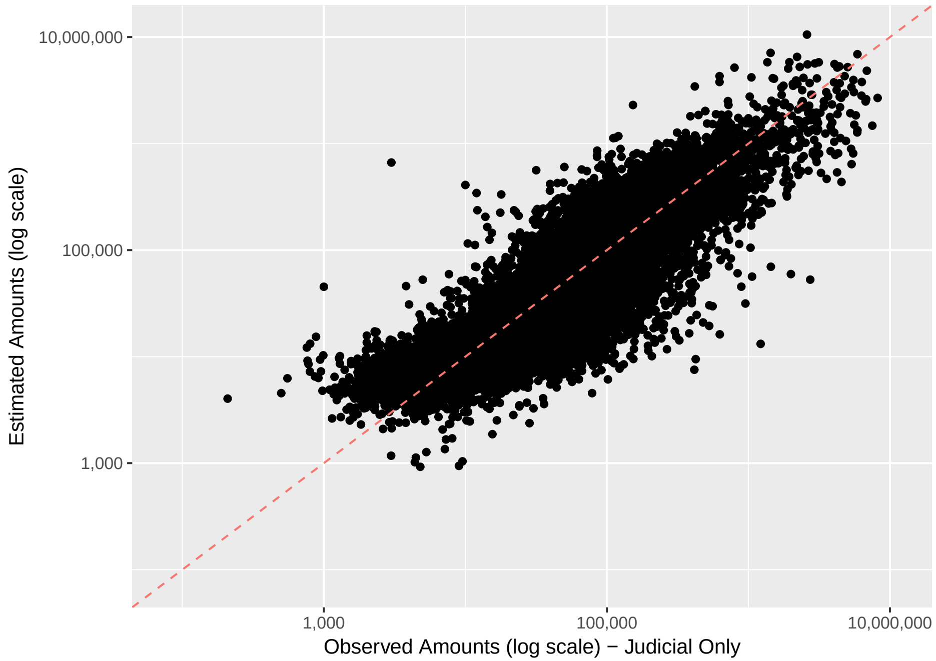






Observed versus Predicted ?

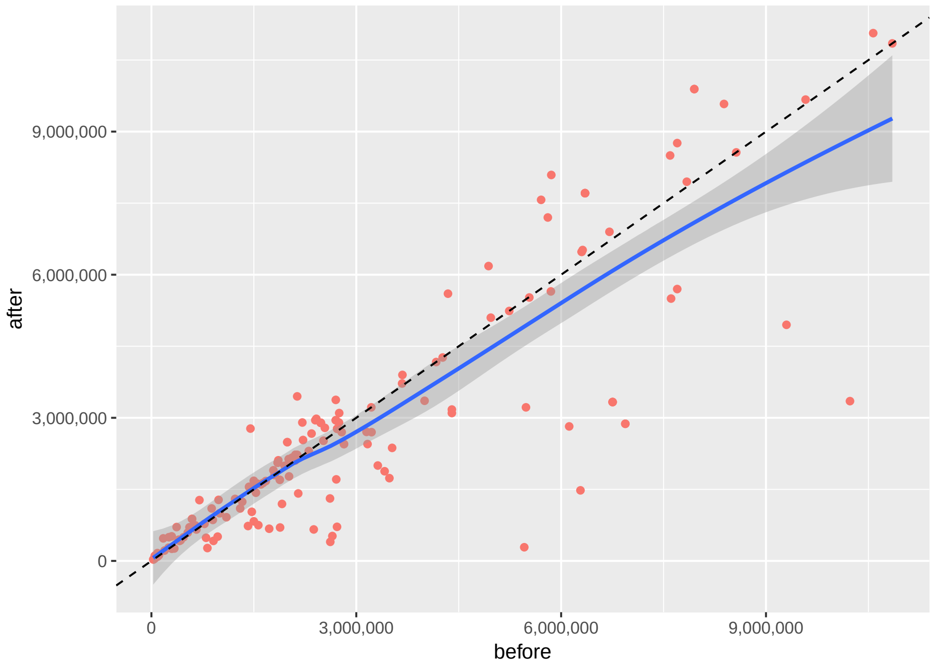


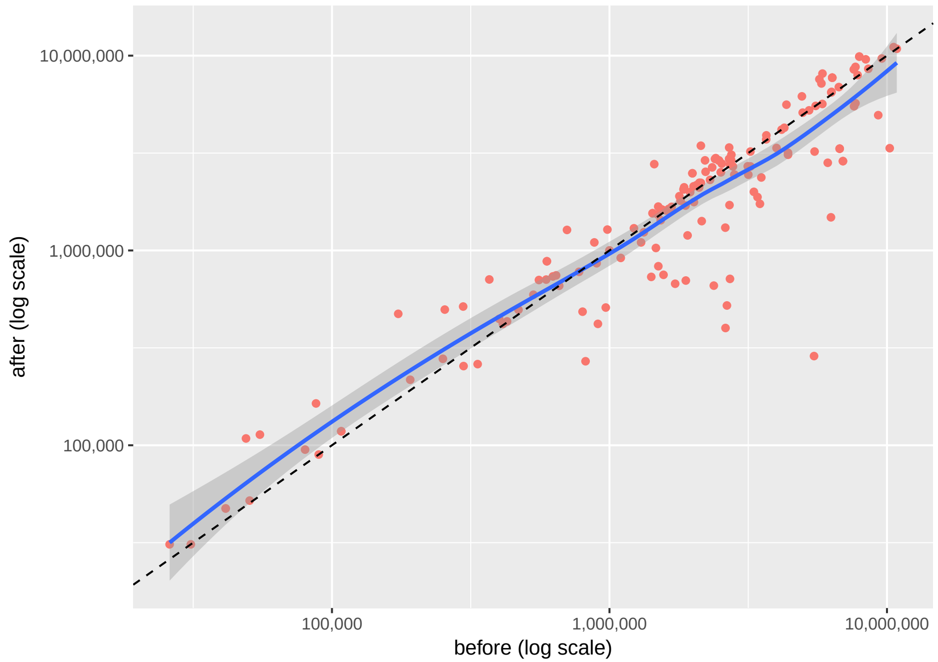


Scatterplot of $(y_S, \widehat{y}_S)$ - 331,113 points - and $(y_T, \widehat{y}_T)$ - 20,893 points.

Insurance Negociation vs. Court ?

Dataset of 100 bodily injury claims from an insurance company

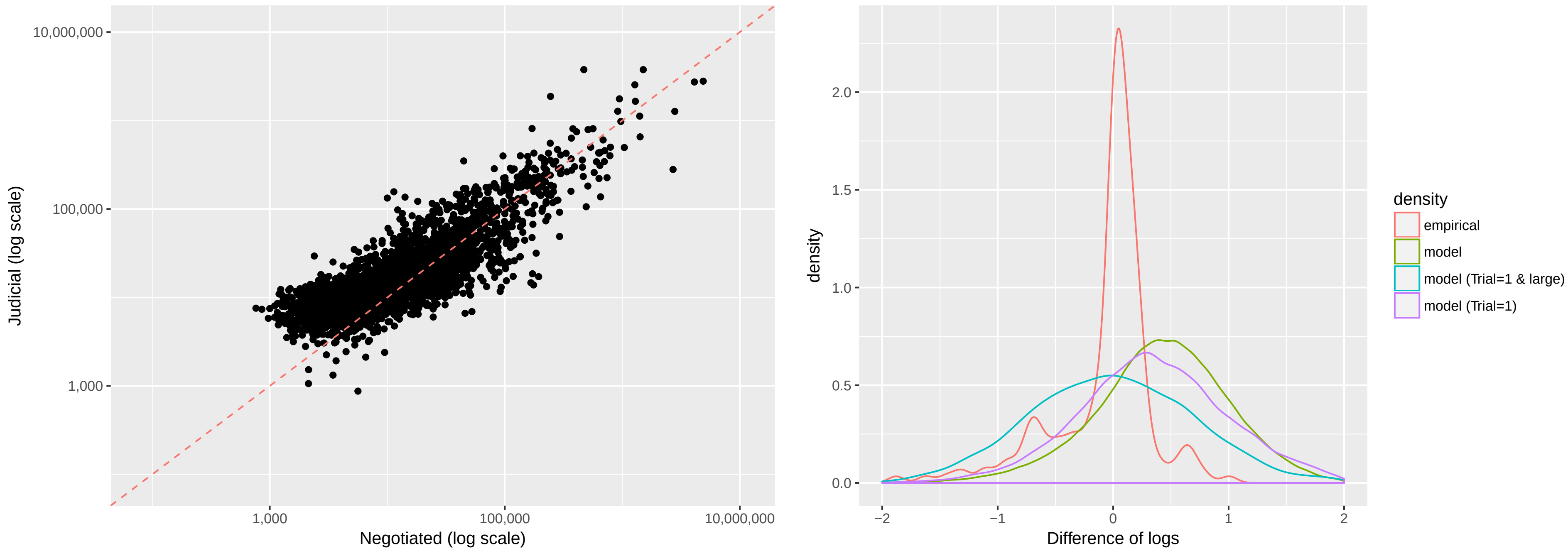




Scatterplot of (y_S, y_T) (for victims who decided to go to court).

Insurance Negociation vs. Court ?

Scatterplot of $(\widehat{y}_S, \widehat{y}_T)$ (for any victim) on the left, and density of $\log(y_T) - \log(y_S)$ (given Trial=1), $\log(\widehat{y}_T) - \log(\widehat{y}_S)$, $\log(\widehat{y}_T) - \log(\widehat{y}_S)$ given Trial=1, and also when $\widehat{y}_S > 100,000$.



Examples

Consider a car accident that occurred in 1996, in an area in the region of *Aix-en-Provence*, where a male passenger of a car, age 52 got a major injury, with around 620 days to recover. That person obtained about 95 thousand euros from court. With our models, we obtained

- a prediction $\widehat{Y}_S$ of 64,306, with 80% confidence interval of $[25,136; 115,478]$
- a prediction $\widehat{Y}_T$ of 65,713, with 80% confidence interval of $[25,698; 117,986]$
- a probability to go to court of 20.8%

Examples

Consider a third accident, that occurred in 2007 in an area in the region of *Rennes*, with a male passenger, age 47, with 575 days to recover. That person got 100 thousand euros by negociating with the insurance company of the driver. With our models, we obtained

- a prediction $\widehat{Y}_S$ of 132,380, with 80% confidence interval of $[51,746;237,724]$
- a prediction $\widehat{Y}_T$ of 134,558, with 80% confidence interval of $[52,621;241,595]$
- a probability to go to court of 16.2%

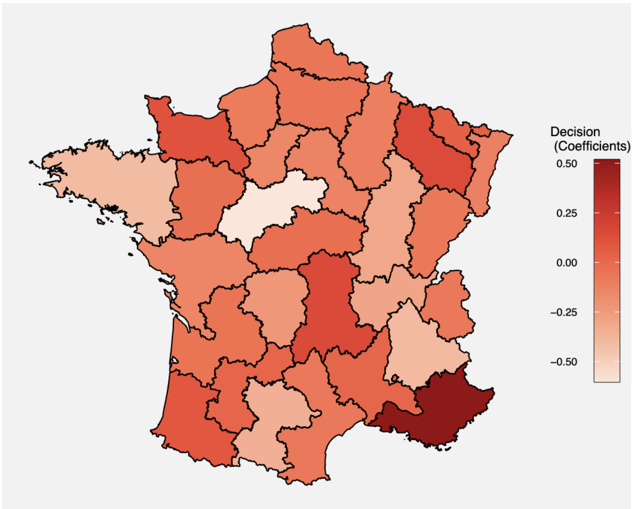
Regression Table Output

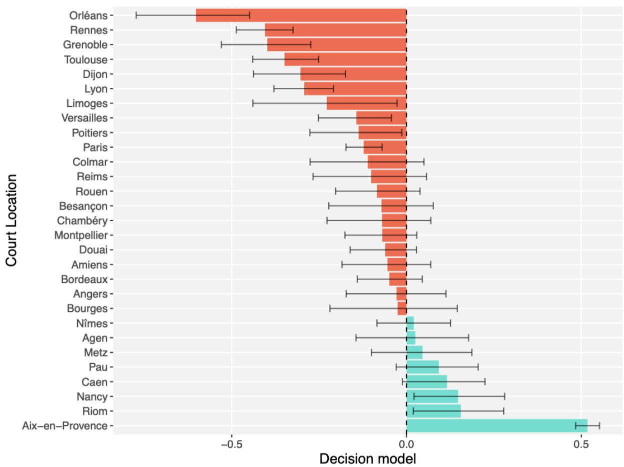
	Dependent variable:				
	Procedure	log(Amount)		log(Length Procedure)	Time difference
	Probit	Compromise	Judicial	Compromise	
	(1)	(2)	(3)	(4)	(5)
Intercept	282.07***	−260.90***	−64.27***	20.15***	-13.19***
Court Location			See Table (III.5)		
Time Difference	−0.31***				
	(0.06)				
log(Settlement date)	−0.08***				
	(0.02)				
log(Amount) diff.	0.26***				
	(0.04)				
log(Amount) diff. (+)	−0.36***				
	(0.06)				
Male	0.001	0.06***	0.05***	−0.01***	0.001
	(0.02)	(0.002)	(0.012)	(0.002)	(0.009)
Age 26-65 (ref: 0-25)	−0.01	0.08***	0.10***	−0.04***	0.07***
	(0.02)	(0.003)	(0.013)	(0.002)	(0.001)
Age 65+	−0.42***	0.40***	0.11***	−0.18***	0.11***
	(0.03)	(0.011)	(0.021)	(0.006)	(0.017)
No details (ref: Driver)	0.42***	−0.16***	0.10***	0.002	0.21***
	(0.03)	(0.009)	(0.015)	(0.005)	(0.014)
Passenger	−0.13***	0.18***	−0.01	0.01***	0.04**
	(0.03)	(0.005)	(0.019)	(0.003)	(0.014)
Biker	0.13**	0.03***	0.12***	0.08***	0.01
	(0.05)	(0.007)	(0.03)	(0.005)	(0.023)
Pedestrian	0.34***	−0.05***	0.09***	0.08***	0.01
	(0.03)	(0.009)	(0.02)	(0.006)	(0.015)
IPP 26-70 (ref: 0-25)	−0.30***	1.24***	0.93***	0.16***	−0.12***
	(0.05)	(0.014)	(0.027)	(0.009)	(0.018)
IPP 70+	−0.81***	2.51***	2.04***	0.30***	−0.21***
	(0.13)	(0.04)	(0.01)	(0.025)	(0.043)
Degree of Suffering	0.41***	0.37***	0.62***	0.07***	−0.06***
	(0.01)	(0.01)	(0.01)	(0.004)	(0.008)
log(Length Hospitalization)	0.21***	0.06***	0.16***	0.06***	−0.06***
	(0.01)	(0.006)	(0.007)	(0.003)	(0.006)
log(Length Recovery)	0.23***	0.08***	0.25***	0.39***	−0.11***
	(0.02)	(0.005)	(0.009)	(0.002)	(0.002)
log(Length Incapacity)	0.02***	0.07***	0.09***	0.0004	−0.004*
	(0.005)	(0.001)	(0.003)	(0.0006)	(0.002)
Year of Accident	−0.14***	0.14***	0.04***	−0.01***	0.01***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.007)
Salary	0.18***				
	(0.02)				
IMR0		1.60***		0.07**	
		(0.054)		(0.028)	
IMR1			−0.32**		0.63***
			(0.135)		(0.096)
Observations	256 469	243 465	13 004	243 465	13 004
R^2		0.7317	0.7551	0.411	0.107
Adjusted R^2		0.7316	0.7542	0.4109	0.104
Log Likelihood	−45 234				
Akaike Inf. Crit.	90 564				
Residual Std. Error		0.54	0.63	0.45	0.48
F Statistic		15 434 ***	929.1***	3951***	36.09***
Note:					*p<0.1; **p<0.05; ***p<0.01

	(1)	(2)	(3)	(4)	(5)
Agen	0.02	-0.01	-0.002	-0.03***	0.05
	(0.082)	(0.058)	(0.042)	(0.008)	(0.035)
Aix-en-Provence	0.52***	-0.39***	-0.06***	0.002	-0.10***
	(0.018)	(0.108)	(0.015)	(0.017)	(0.013)
Amiens	-0.05	0.10**	0.01	0.03***	-0.02
	(0.064)	(0.044)	(0.035)	(0.007)	(0.03)
Angers	-0.03	0.10**	0.09**	-0.04***	0.06**
	(0.077)	(0.053)	(0.046)	(0.008)	(0.031)
Besançon	-0.07	0.12**	0.01	0.04***	-0.04
	(0.073)	(0.051)	(0.043)	(0.008)	(0.033)
Bordeaux	-0.05	0.05	0.13***	-0.02***	0.03
	(0.048)	(0.035)	(0.028)	(0.005)	(0.023)
Bourges	-0.03	0.11	0.06	-0.07***	0.03
	(0.098)	(0.068)	(0.056)	(0.011)	(0.042)
Caen	0.12*	-0.03	0.10***	0.0002	-0.06**
	(0.06)	(0.048)	(0.035)	(0.008)	(0.029)
Chambéry	-0.07	0.05	-0.03	-0.04***	0.08**
	(0.074)	(0.054)	(0.047)	(0.008)	(0.033)
Colmar	-0.11	0.17***	0.05	0.03***	0.09**
	(0.081)	(0.062)	(0.043)	(0.009)	(0.038)
Dijon	-0.30***	0.21***	-0.02	-0.03**	0.03
	(0.067)	(0.074)	(0.045)	(0.012)	(0.032)
Douai	-0.06	0.08**	0.01	0.04***	0.03
	(0.048)	(0.035)	(0.027)	(0.006)	(0.022)
Grenoble	-0.40***	0.23***	-0.09**	-0.03**	0.08**
	(0.066)	(0.085)	(0.043)	(0.014)	(0.031)
Limoges	-0.23**	0.17**	0.04	-0.10***	0.08*
	(0.105)	(0.082)	(0.058)	(0.012)	(0.048)
Lyon	-0.29***	0.17***	-0.04	0.03***	-0.03
	(0.043)	(0.061)	(0.026)	(0.009)	(0.021)
Metz	0.05	0.08	-0.01	0.002	0.17***
	(0.075)	(0.052)	(0.044)	(0.009)	(0.044)
Montpellier	-0.07	0.12***	0.05*	0.004	0.04*
	(0.053)	(0.041)	(0.03)	(0.006)	(0.025)
Nancy	0.15**	-0.02	0.13***	-0.01	-0.07**
	(0.065)	(0.055)	(0.038)	(0.009)	(0.031)
Nîmes	0.02	-0.001	-0.04	-0.02***	0.02
	(0.054)	(0.037)	(0.032)	(0.005)	(0.026)
Orléans	-0.60***	0.33***	-0.07	0.004	0.01
	(0.085)	(0.126)	(0.053)	(0.02)	(0.043)
Paris	-0.12***	0.08**	0.05***	0.08***	0.05***
	(0.026)	(0.035)	(0.017)	(0.006)	(0.013)
Pau	0.09	-0.10**	0.01	-0.09***	0.05*
	(0.06)	(0.044)	(0.039)	(0.007)	(0.029)
Poitiers	-0.14*	0.15***	0.09**	-0.03***	0.01
	(0.07)	(0.053)	(0.044)	(0.008)	(0.029)
Reims	-0.10	0.11*	-0.04	-0.04***	0.01
	(0.082)	(0.059)	(0.055)	(0.009)	(0.039)
Rennes	-0.40***	0.25***	0.003	-0.05***	0.07***
	(0.042)	(0.085)	(0.028)	(0.013)	(0.021)
Riom	0.16**	-0.06	0.04	-0.04***	-0.04*
	(0.067)	(0.057)	(0.04)	(0.01)	(0.027)
Rouen	-0.08	0.08*	-0.02	0.03***	-0.003
	(0.06)	(0.045)	(0.029)	(0.007)	(0.026)
Toulouse	-0.35***	0.21***	-0.04	-0.06***	0.02
	(0.05)	(0.078)	(0.034)	(0.012)	(0.023)
Versailles	-0.14***	0.06	0.06*	0.03***	0.01
	(0.052)	(0.046)	(0.035)	(0.007)	(0.025)
Note:					*p<0.1; **p<0.05; ***p<0.01

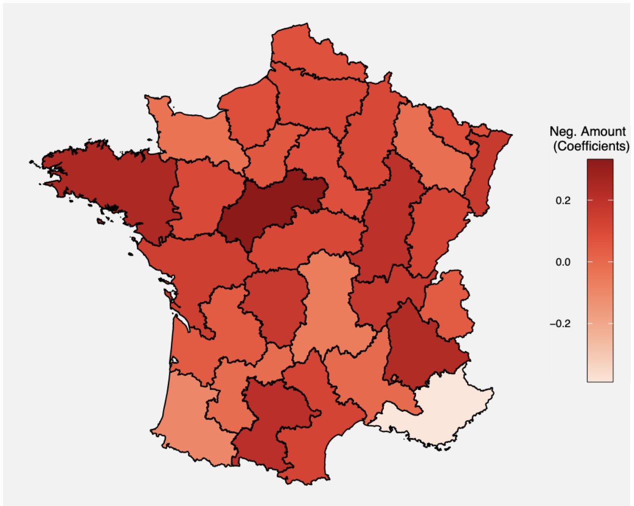
The Spatial Component

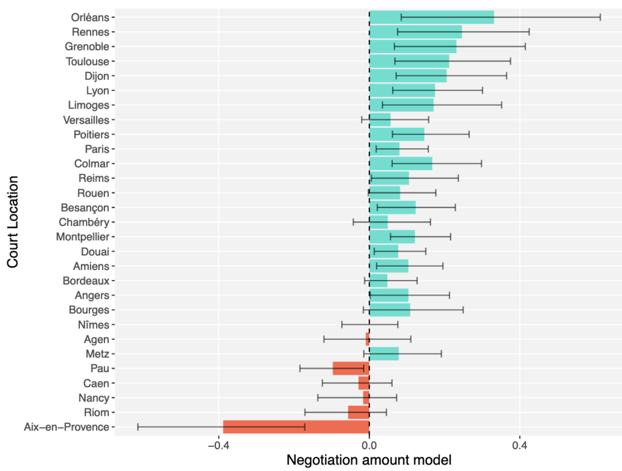
decision to go to court



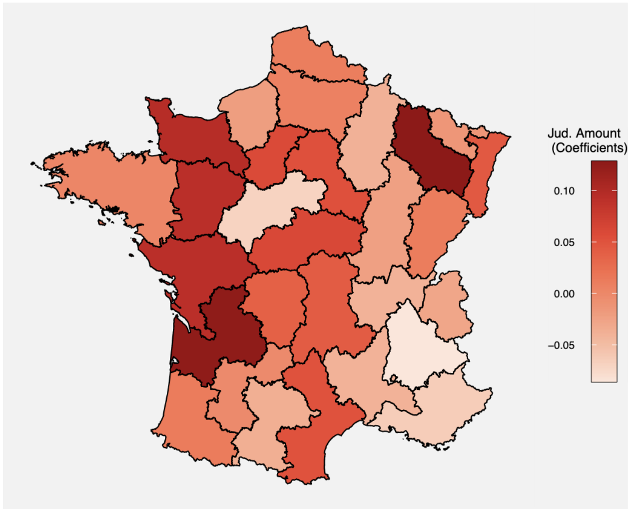


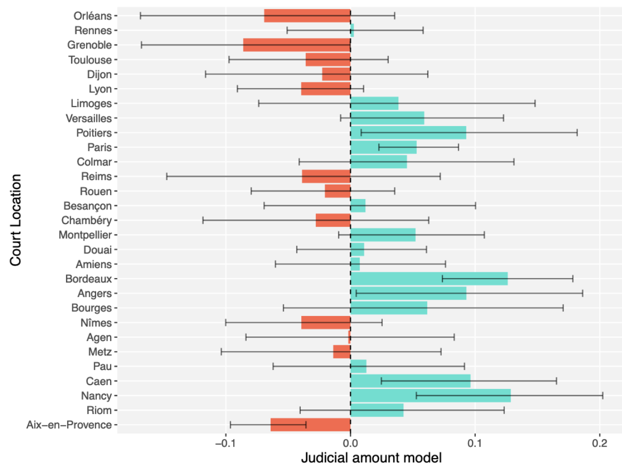
amount y_S





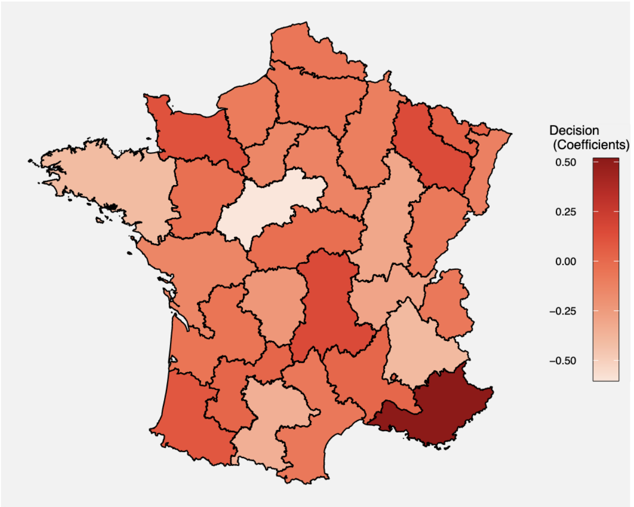
amount y_T

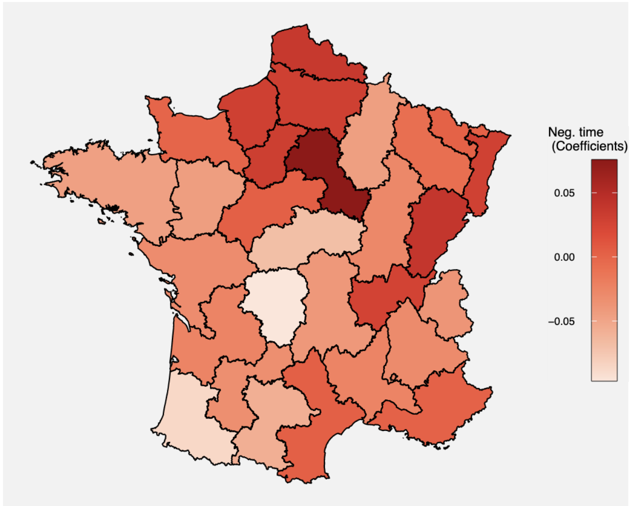


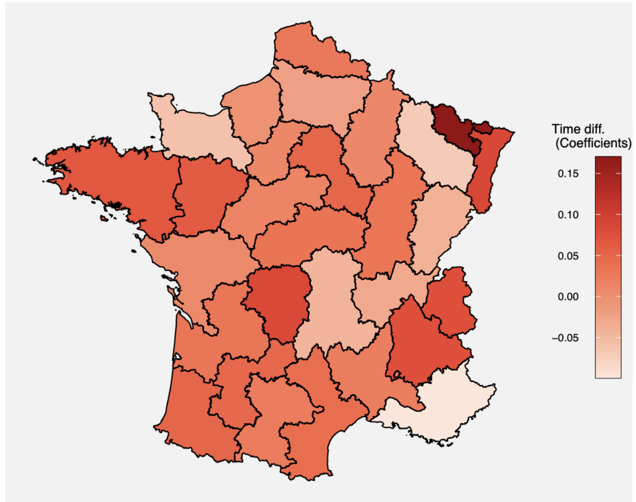


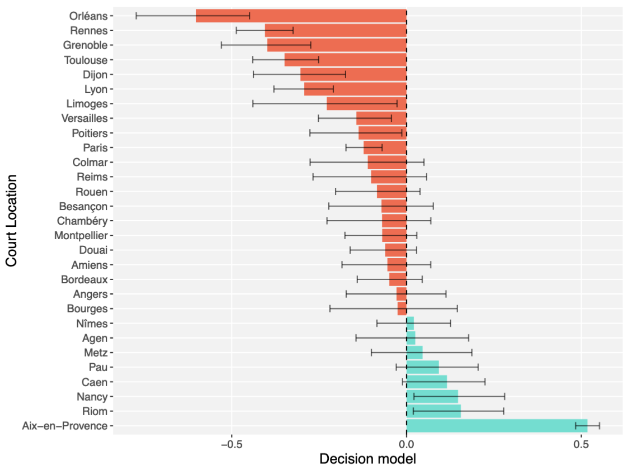
The Spatial Component

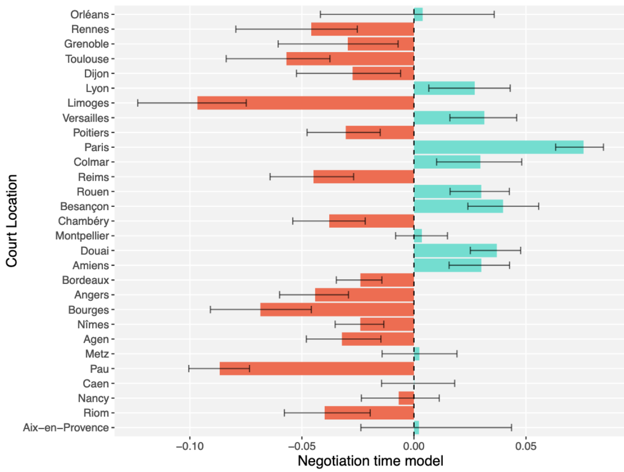
decision to go to court | time t_S | time h

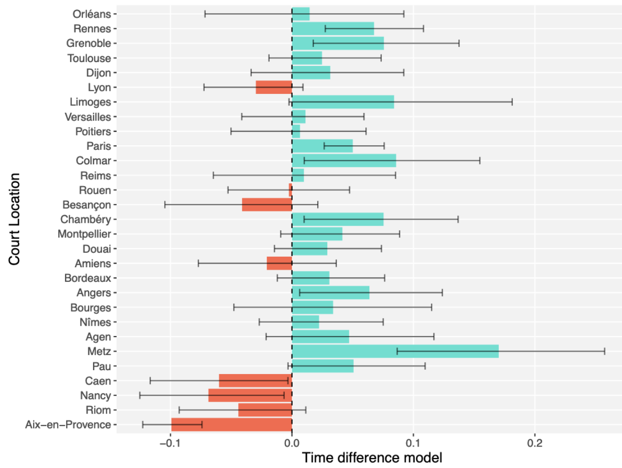




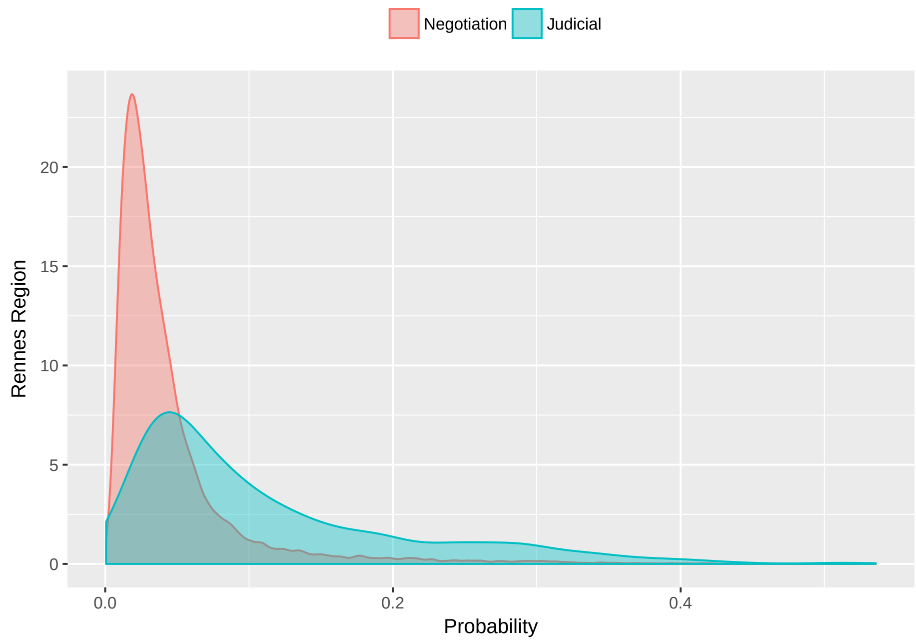






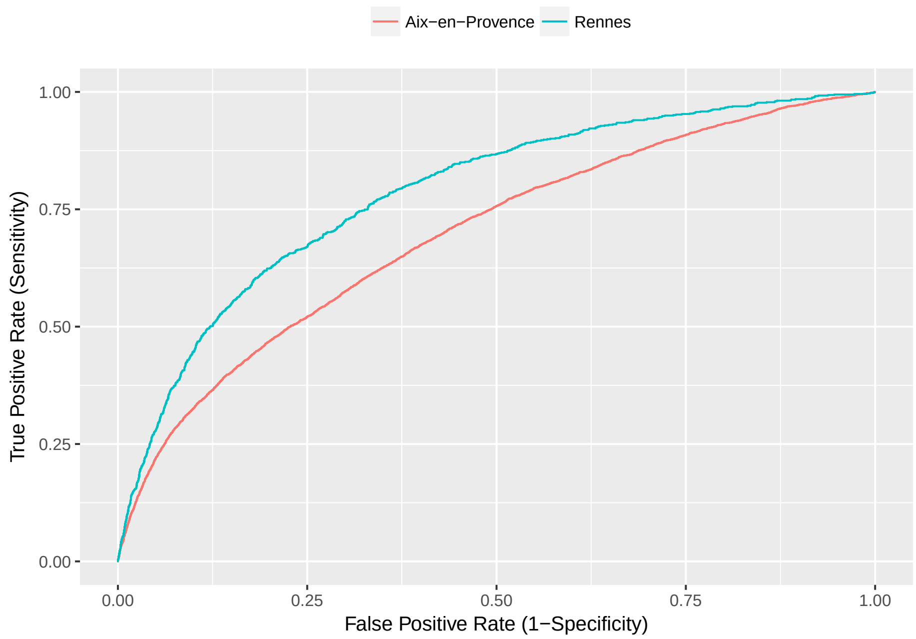


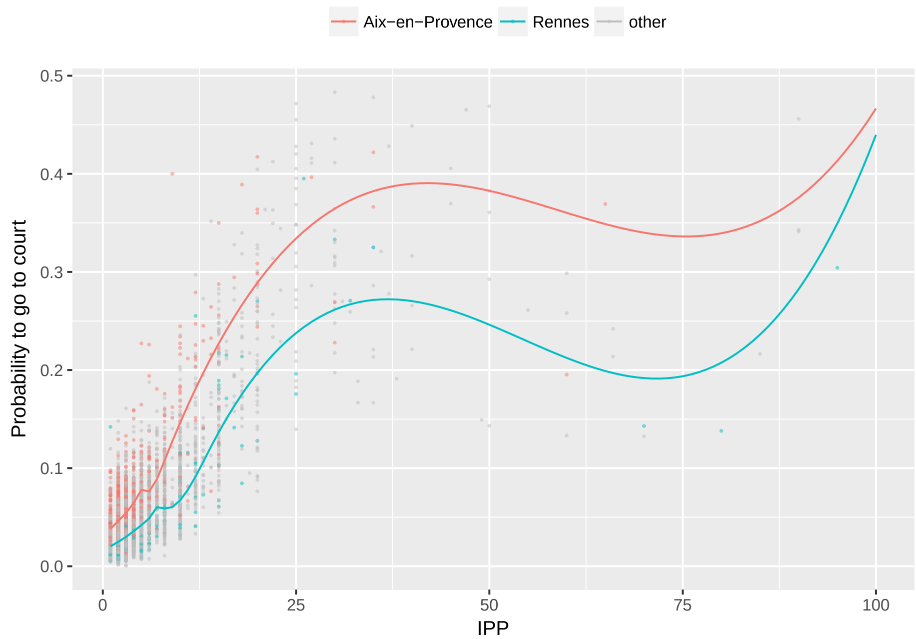
Rennes, Confusion Matrix & Score Distribution



Rennes vs. Aix-en-Provence

ROC curves for the probability to go to court, in Rennes and in Aix-en-Provence.





Local (smooth) regression : probability to go to court as a function of IPP, in Rennes and in Aix-en-Provence.

Rennes vs. Aix-en-Provence: Temporal Evolution