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Abstract:

While there is a fairly extensive literature on the relationship between weather and productivity, little research has focused on the impact of weather on judicial activity. The findings from the few investigations conducted arrive at different conclusions depending on the country. We contribute to this area of research by conducting the first analysis using French data. We propose an empirical analysis of the impact of outdoor temperature and rainfall levels on court decisions made in French courts of appeal during divorce proceedings, based on a sample of approximately 4,000 court decisions correlated with daily and geo-localized meteorological data. The analysis focuses on decisions regarding the amount of child support to be paid. We show that, all other things being equal, when it is very hot at night preceding the judgment, the panels of judges tend to set lower amounts of child support.

Highlights:

- Judges set lower child support payments when it is very hot at night
- One degree more in minimum daily temperature equals 0.4% less in child support set by judges
- First research on the link between weather and judicial activity in France

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1. Introduction

An abundant literature, synthesized in a meta-analysis (Hancock *et al.*, 2007), attests that the weather, and particularly the temperature, has an impact on productivity, even for indoor activities. Weather is also thought to influence different types of decision-making, such as buy and sell orders on stock exchange trading floors (Hirshleifer and Shumway, 2003), the selection of university applicants (Simonsohn, 2007), students' college choice (Simonsohn, 2010), daily labor supply (Graff and Neidell, 2014), rejection of industrial patent applications (Kovacs, 2017) and the intensity of police and safety food control activities (Obradovich *et al.* 2018).

The literature on the link between weather and judicial activity is less extensive and very recent. Chen (2019) showed that in U.S. immigration courts, the proportion of favorable asylum decisions tends to be negatively correlated with “bad weather” on the day of the decision. Heyes and Saberian (2019) estimated that a 10-degree Fahrenheit increase in outdoor temperature reduces the likelihood of granting asylum in the United States by 1.1 percentage points and reduces the likelihood of parole by 1.6 percentage points in California's correctional courts. Kahn and Li (2019), using Chinese data, showed that the probability of a case going to appeal is significantly positively correlated with the outdoor temperature on the day of the trial decision. In contrast, using Czech, Australian and Chinese data, respectively, Drapal and Pinal-Sanchez (2019), Evans and Siminsky (2020), and Hou and Wang (2020) concluded that there is a lack of significant impact of weather on criminal justice decisions.

Following these rare studies, we investigated the influence of the weather on decisions made by judges in French courts of appeal regarding the amount of child support to be paid in divorce proceedings. In line with the literature cited above, two types of hypothesis can be put forward to justify this type of influence. On the one hand, exposure to very high temperatures may lead to physiological conditions (fatigue, apathy, impaired attention and concentration, irritation, etc.) that disrupt judges' decision-making behavior. On the other hand, judges' perception of weather (“good” or “bad”) could impact their work motivation, either via their mood or via their reasoning in terms of choice of competing activities whose marginal utility may vary according to their perception of the weather. We believe that divorce litigation lends itself well to the analysis of potential weather-related behavior for several reasons: e.g., mass litigation that requires rapid processing, repetitive cases in terms of content, and cases that generally present no real processing difficulties in a field of law that is not highly valued by

the professional community of judges. On the other hand, as we are analyzing appeal court files, these considerations need to be nuanced. First, the number of cases to be dealt with on appeal is lower than in courts of first instance and, second, the cases are judged in France by a panel of three judges, which suggests that the potential impact of weather may be reduced by the joint effort of working together.

2. Data and econometric design

Our analysis was carried out on a random sample of decisions drawn from the exhaustive list of judgements made by the French courts of appeal managed by the *Cour de Cassation*. It covers the years 2008 and 2016 and consists of 4,023 cases, for which at least one child support decision was made by the judges (7,262 decisions). We excluded 125 cases where the parents agreed on the amount of child support and only asked the appeal judge for approval. Given the date of the judgment for each of the cases, we were able to match the file of judgments with a file of daily and geolocated meteorological data from the 36 towns and cities concerned: i.e., rainfall, minimum, average and maximum temperature, average temperature for the month.

Technically, to the extent that decisions for multiple children from the same family are not independent, we randomly drew only one child per group of siblings to avoid a non-independence bias. We estimated fixed-effects regressions for the decisions of one child in each of the cases i decided in the court of appeal c on date t , of type,

$$\text{Ln(Child Supply)}_{ict} = \alpha + \beta_1 T_{ct} + \beta_2 P_{ct} + \beta_3 X_i + \beta_4 C_c + \gamma_c + Y_t + M_t + \Theta_t + \varepsilon_{ict},$$

where T_{ct} is the outdoor temperature on date t in city c , meaning that β_1 is the central coefficient in our analysis measuring the impact of temperature (according to different alternative measures: see Table 1) on the court's decision. Our specification included various control variables: a precipitation indicator and a snow indicator on day t in city c (P_{ct}), eighteen features describing case i , including case-specific procedural elements (X_i), and a particular feature of the appellate court, namely the gender composition of the panel of judges (C_c). To ensure that the effects associated with dated and geolocated weather parameters were not disturbed by other unobserved factors, and to take into account the fact that France is not entirely geographically homogeneous in terms of climate, we introduced fixed effects of geographic location (γ_c) and time: year (Y_t), month (M_t) and day of the week (Θ_t). Since the control variables are sometimes affected by missing data, we adopted a multiple imputation procedure in an attempt to reduce any possible bias from the exclusion of some observations due to missing data.

The small size of our sample did not allow us to introduce a judge panel fixed effect, as many panels in our sample were only involved in one or a very limited number of cases. However, we believe that while it is useful to try to control for the invariant dimension of judges in decisions where the judgment is made by a single judge, this fixed effect strategy seems less relevant when the decision is collegial, as it is less likely that a panel of three judges will have relatively constant group consistency over time, especially given the turnover between panels and between jurisdictions. Consequently, it seems to us that consistency over time of the judicial policies of the court of appeal is a more appropriate factor to take into account, which is why we introduced a fixed effect of courts of appeal.

The estimate of the amount of child support raises the specific question of the fairly numerous (20%) decisions by judges not to award support. We hypothesize that the decision is sequential: the panel of judges first decides to award child support (or not), and then decides on the amount in the case of a positive first stage. To account for this decision-making mechanism, we used a two-equation simultaneous “Heckman” (Heckit) regression, with correction for possible selection bias.

The six explanatory factors of the Probit selection equation we retained relate to the institutional logic that may lead judges not to set child support. The estimated coefficients associated with these different factors are highly significant, fully validating our hypotheses regarding the reasons behind this decision. Another technically important result is that the coefficient associated with the inverse of the Mills ratio is not significant at the 10% level, which protects us from a possible selection bias when working only with non-zero amounts of child support.

3. Results relative to the impact of the weather

The decision-making behavior of judges in establishing child support amounts on appeal does not appear to be particularly sensitive to external weather conditions. There is no statistically significant relationship with indicators of precipitation or with indicators of average or maximum temperature. The only statistically significant relationship, evidenced by three alternative indicators, which are therefore mutually supportive (see Table 1), is a negative relationship between the minimum daily outdoor temperature and the amount of child support. Judges, all other things being equal, award significantly lower support amounts when the minimum outdoor temperature is warmer (with a greater effect when the minimum temperature is above 23°C), i.e., when the nighttime temperature preceding the judgment is

quite high (the day's minimum temperature is almost always observed between midnight and sunrise), which for some people may be a sleep-disrupting factor.

Table 1. Impact of minimum temperature on the judgement day on the logarithm of the child support amount set by judges

	(1)	(2)	(3)
Minimum daily temperature	-0.0039** (0.0018)	/	/
Minimum temperature in classes			
<= -6°C	/	+0.0234 (0.0636)	/
] -6°C; -1°C]	/	+0.0483 (0.0296)	/
] -1°C; 8°C]	/	+0.0130 (0.0195)	/
]8°C ; 16°C]	/	Ref.	/
]16°C ; 19°C]	/	-0.0724** (0.0307)	/
]19°C ; 23°C]	/	+0.0607 (0.0547)	/
> 23°C	/	-0.2910** (0.1201)	/
Daily minimum temperature minus monthly average temperature	/	/	-0.0036* (0.0019)
Daily rainfall	-0.0003 (0.0012)	-0.0003 (0.0012)	-0.0003 (0.012)
Snow	+0.0088 (0.0444)	+0.0109 (0.0444)	+0.0119 (0.0444)

Source: 2008 and 2016 court of appeals decisions from JURICA and Météo-France data. N = 3,898. Estimates include fixed effects of court of appeal location, day of the week, month and year, as well as 24 control variables related to cases, procedural items and judges (see detailed results in appendix). *: $p < 0.1$. **: $p < 0.05$. Standard error in brackets. $R^2 = 0.78$.

To illustrate this finding with a single numerical example, the regression coefficient equal to – 0.0039 in model 1 means that, *ceteris paribus*, when the minimum daily temperature is one degree higher, the amount of child support set by judges is 0.4% lower. At an average observed non-zero child support value (215€), this reduction is therefore less than one euro (83 cents, calculated with the correction of Duan's smearing factor), which is relatively negligible.

4. Conclusion

To our knowledge, this result on the link between weather and court decisions is the first to be obtained from French data. In identifying a statistically significant relationship, our research is closer to the US results than to the other studies (China, Australia, Czech Republic). However, it should be emphasized that the results we obtained are based on fragile estimates: on the one hand, the estimated coefficients are at significance levels never below 1% and, on the other hand, the negative relationship is drawn from the effect associated with observations of minimum temperatures at the tail of the distribution, which, by definition, are few in number. This comparative conclusion may also depend on certain limitations in our empirical work, notably the small size of our sample and the absence of meteorological data often used in the literature, such as the degree of cloud cover and air pollution.

Declarations of interest: none.

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Appendix 1. Estimates of the amount of child support (Log) set by the panel of judges on appeal

<i>Equation selection (Probit: probability that the amount = 0)</i>	(1)	(2)	(3)
Constant	-2.239***	-2.239***	-2.240***
Amount of child support in first instance = 0	1.637***	1.637***	1.637***
Supply and demand of the parties = 0	1.955***	1.955***	1.955***
Low non-zero supply	0.878***	0.878***	0.878***
The debtor parent benefits from legal aid	0.532***	0.532***	0.532***
The debtor parent has a low income	0.437***	0.436***	0.437***
Child's age > 17 years	0.550***	0.550***	0.550***
Constant	4.576***	4.564***	4.567***
Inverse of the Mills Ratio	-0.048	-0.049	-0.047
Amount of child support in first instance/1,000	1.592***	1.593***	1.594***
Amount of child support in first instance squared/100,000	-0.029***	-0.028***	-0.029***
Amount of the supply/1,000	0.619***	0.624***	0.617***
Amount of the supply squared/100,000	-0.022*	-0.023**	-0.021*
Amount of the demand/1,000	0.741***	0.746***	0.742***
Amount of the demand squared/100,000	-0.012***	-0.013***	-0.012***
Amount of debtor's income/100	0.005***	0.005***	0.005***
Amount of debtor's income squared/1,000,000	-0.001***	-0.001***	-0.001***
The debtor parent reports capital income	0.083***	0.083***	0.083***
The panel of judges has doubts about the debtor's income	0.059***	0.059***	0.060***
The creditor parent has specific charges concerning the child	0.033**	0.033**	0.033**
<i>Parents live in the same department</i>	Ref.	Ref.	Ref.
Parents live in neighboring departments	-0.060**	-0.060***	-0.060***
Parents live in non-adjacent departments	0.018	0.018	0.017
One of the parents is abroad	0.073*	0.063*	0.073*
The creditor parent lives as a couple	-0.063***	-0.061***	-0.063***
<i>No Legal Aid for the debtor parent</i>	Ref.	Ref.	Ref.
Partial Legal Aid for the debtor parent	-0.203***	-0.202***	-0.202***
Full Legal Aid for the debtor parent	-0.327***	-0.325***	-0.327***
<i>No Legal Aid for the creditor parent</i>	Ref.	Ref.	Ref.
Partial Legal Aid for the creditor parent	0.008	0.011	0.009
Full Legal Aid for the creditor parent	-0.048***	-0.048***	-0.047***
Number of children in the family	-0.067***	-0.067***	-0.068***
<i>The child's main residence is with the mother</i>	Ref.	Ref.	Ref.
Almost exclusive accommodation with the mother	-0.048**	-0.048***	-0.048***
Adult child: no court decision on where to live	-0.052**	-0.054**	-0.052**
Child in shared custody	-0.180***	-0.184***	-0.179***
Child's age	0.006***	0.006***	0.006***
<i>The mother is the creditor and the defendant</i>	Ref.	Ref.	Ref.
The mother is the debtor and the appellant	-0.133***	-0.135***	-0.133***
The mother is the debtor and the defendant	-0.149***	-0.147***	-0.149***
The mother is the creditor and the appellant	0.032**	0.031*	0.032**
<i>Contradictory judgement</i>	Ref.	Ref.	Ref.
Default judgement	-0.076**	-0.079**	-0.077**
Judgment deemed to be contradictory	-0.168***	-0.166***	-0.168***
Expertise requested by the appeal judges	-0.063	-0.061*	-0.062*
<i>Mixed panel of judges</i>	Ref.	Ref.	Ref.
Panel of three men	0.042	0.046	0.043
Panel of three women	0.052***	0.055***	0.053***
Daily minimum temperature in continuous value	-0.0039**	/	/
Minimum daily temperature in classes: <= -6°C	/	0.0234	/
]-6°C ; -1°C]	/	0.0482	/
]-1°C ; +8°C]	/	0.0130	/
]+8°C ; +16°C]	/	Ref.	/
]+16°C ; +19°C]	/	-0.0724**	/
]+19°C ; +23°C]	/	0.0607	/
> +23°C	/	-0.2910**	/
Daily minimum temperature – monthly average temperature	/	/	-0.0036*
Daily rainfall (mm)	-0.0003	-0.0003	-0.0004
Snow	0.0088	0.0109	0.0119

Source: 2008 and 2016 court of appeals decisions from JURICA and Météo-France data. N = 3,898. Estimates include fixed effects of court of appeal location, day of the week, month and year. *: p < 0.1. **: p < 0.05. ***: p < 0.01.