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1.Introduction: motivation & topic clarification.

- 2.Research hypotheses.
- 3.Data & methods.
- 4.Results.
- 5.Future work.

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Introduction: motivation



Introduction: motivation

Why the Polish judicial system?



The system is seen as slow and ineffective in the literature

Still, 14th place in UE when it comes to adjudication time for non-administrative cases Second highest share of judicial system expenditure in GDP among EU countries in 2019 (~0.5%)

Introduction: research contribution

- The analysis assumes a **certain measure of system effectiveness** that is neglected in a vast majority of researches.
- The research covers **several "branches" of law**: civil, criminal, labour, family, commercial.
- Usually it is econometrics that is applied to judicial systems effectiveness analyses. In this research machine learning tools are used.
- The research includes **unstructured**, **textual data** analysis.

See: Bełdowski, Dąbroś & Wojciechowski (2020), Kruczalak-Jankowska, Maśnicka & Machnikowska (2020), Siemaszko, Ostaszewski & Włodarczyk-Madejska (2019), CEPEJ (2018), Dimitrova-Grajzl et al. (2016), Voigt i El-Bialy (2016), Falavinga et al. (2015), Garcia-Posada & Mora-Sanguinetti (2015), Castro & Guccio (2014), Santos & Amado (2014), Siemaszko & Ostaszewski (2013), Christensen & Szmer (2012), de Castro (2009), Moolenaar (2009), El-Bialy & Garcia-Rubio (2007), Mitropoulos & Pelagidis (2007), Santos & Amado (2007), Kittelsen & Forsund (1992), Kakalik & Ross (1983).

Introduction: the Polish judicial system



Introduction: the Polish judicial system



Introduction: "effectiveness"



See: Bełdowski, Dąbroś & Wojciechowski (2020), Kruczalak-Jankowska, Maśnicka & Machnikowska (2020), Siemaszko, Ostaszewski & Włodarczyk-Madejska (2019), CEPEJ (2018), Dimitrova-Grajzl et al. (2016), Voigt i El-Bialy (2016), Falavinga et al. (2015), Garcia-Posada & Mora-Sanguinetti (2015), Castro & Guccio (2014), Santos & Amado (2014), Siemaszko & Ostaszewski (2013), Christensen & Szmer (2012), de Castro (2009), Moolenaar (2009), El-Bialy & Garcia-Rubio (2007), Mitropoulos & Pelagidis (2007), Santos & Amado (2007), Kittelsen & Forsund (1992), Kakalik & Ross (1983).

Introduction: "effectiveness"



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Simplifying, appeals aim ensuring "fair" sentences. Still, they generate **additional costs**, **increase time to resolve**, **involve more judges**. Maybe **IN SOME CASES** it can be avoided? (more detailed courts specification, more expert opinions in certain problems, procedural changes, more convincing judgements justifications...)

Introduction: "effectiveness"

- In this research, probability of appeal is used as a measure/proxy for judicial system effectiveness.
- It captures one of four effectiveness components ("fairness").
- Still, it **relates to two other components** (number of judges, time needed for solving a case).
- Using probability of appeal **DOES NOT** mean that reducing number of appeals is in general a good solution. **Right of appeal should not be undermined**.
- It means that IN SOME CASES, with certain improvements, number of unnecessary appeals can be minimized to improve the system.
- Also, probability of appeal can be perceived as a measure of groups of cases complexity. It enables finding most problematic ones and identify the system "bottlenecks".



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Research hypotheses

The thematic groups detected, within which cases have been predominantly resolved in **courts' departments of identical specialisation**, are characterised by a **similar probability of appeal**.

••••

The thematic groups detected, within which cases have been resolved in **courts' departments of different specialisations**, are characterised by a **higher probability of appeal** than the subject groups in which cases have been predominantly resolved in departments of identical specialisation.

Some thematic groups of judgements are **observed seasonally**.

The probability of appeals in the thematic groups of judgements is characterised by **seasonality** – it increases in the last quarter.



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Data

- Polish regional courts judgements published on the portal of the Polish Ministry of Justice: <u>orzeczenia.ms.gov.pl</u>.
- The scope of the published judgements determined by the panel of judges.
- All available judgements from **2016-2019** were collected (~40 000 judgements).
- It was verified for each of the judgements collected whether an appeal had been filled.
- Web scraping and crawling techniques were used.
- Data preparation for modelling:
 - **bi- and trigrams** were introduced,
 - lemmatization applied,
 - non-informative words were removed from the corpus.



See: Blei & Lafferty (2007), Blei, Ng & Jordan (2003), Landauer, Foltz & Laham (1998), Landauer & Dumais (1997).



Polish regional courts judgements

See: Blei & Lafferty (2007), Blei, Ng & Jordan (2003), Landauer, Foltz & Laham (1998), Landauer & Dumais (1997).

Number of topics need to be declared; here it was chosen based on well-established **perplexity** measure



Polish regional courts judgements

Topics obtained

See: Blei & Lafferty (2007), Blei, Ng & Jordan (2003), Landauer, Foltz & Laham (1998), Landauer & Dumais (1997).



Judgements contain words assigned to different topic; as a result, each judgement is assigned to many topics with different probabilities

Each topic is characterized with keywords with estimated weights



Each judgements can be assigned the most probable topic



Judgements assigned to a topic may come from different types of regional courts' departments Shares of judgments from departments of a given type in the total number of judgments allocated to a given topic



allocated to a given topic

from different types of regional courts' departments

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Results – 24 topics obtained





Results – looking for "border" topics



^ MEASURE: the ratio of the two largest shares of judgements from departments of a given type for each of the topics obtained.



Topic label, number	Number of judgements	of Appeals	Within-topic share of departments:						
		share	civil	criminal	commercial	family and juvenile	labour, social insurance		
Insanity; 5	1 225	13.31%	57.88%	39.51%	0.65%	0.24%	1.71%		
			Appeals share calculated for all judgements from department:						
The ratio of the two largest shares of judgments from departments of a given type: 1.46		civil	criminal	commercial	family and juvenile	labour, social insurance			
		7.67%	11.91%	5.17%	10.10%	3.74%			

^ Appeals share in this topic (13.31%) is higher than the average shares among departments of each type (3.74-11.91%).

Results – are there more "border" topics?



^ MEASURE: the ratio of the two largest shares of judgements from departments of a given type for each of the topics obtained.



Topic label, number	Number of	Appeals	Within-topic share of departments:					
	judgements	share	civil	criminal	commercial	family and	labour,	
						juvenile	social	
							insurance	
Burglary,	2 407	9.18%	34.90%	56.46%	5.65%	0.25%	2.74%	
neurological								
diseases,								
construction; 16								
			Appeals share calculated for all judgements from department:					
The ratio of the two largest shares of		civil	criminal	commercial	family and	labour,		
judgments from departments of a given type:					juvenile	social		
1.62						insurance		
1.02			7.67%	11.91%	5.17%	10.10%	3.74%	

^ Appeals share in this topic (9.18%) is lower than the average shares among departments of each type (3.74-11.91%).

Results – are there more "border" topics?



^ MEASURE: the ratio of the two largest shares of judgements from departments of a given type for each of the topics obtained.



Topic label, number	Number of	Appeals	Within-topic share of departments:						
	judgements	share	civil	criminal	commercial	family and juvenile	labour, social		
							insurance		
Burglary, theft,	974	9.55%	32.44%	62.11%	3.39%	0.21%	1.85%		
assault; 24									
			Appeals	Appeals share calculated for all judgements from department:					
The ratio of the two largest shares of		civil	criminal	commercial	family and	labour,			
judgments from departments of a given type:					juvenile	social			
1 91						insurance			
1.91			7.67%	11.91%	5.17%	10.10%	3.74%		

^ Appeals share in this topic (13.31%) is higher than the average shares among departments of each type (3.74-11.91%).

Results – are there more "border" topics?



^ MEASURE: the ratio of the two largest shares of judgements from departments of a given type for each of the topics obtained.

penitentia inaccuracy Discipl	ary inary_	progr	lostic teward
subc	ul	tu	re
software	reg	ular	critically egulations
CO print	n	nat	-e
exchange absorb burdenelect	ntertempo	ralover	sight

Topic label, number	Number of	Appeals	Within-topic share of departments:				
	judgements	share	civil	criminal	commercial	family and	labour,
						juvenile	social
							insurance
Implementing	915	8.31%	32.86%	63.72%	0.87%	0.11%	0.44%
criminal law							
provisions; 12							
			Appeals share calculated for all judgements from department:				
The ratio of the two largest shares of			civil	criminal	commercial	family and	labour,
judgments from departments of a given type:					juvenile	social	
1 93							insurance
1.83			7.67%	11.91%	5.17%	10.10%	3.74%

^ Appeals share in this topic (8.31%) is higher than the average shares among departments of each type (3.74-11.91%).

Results – seasonality of topics occurrence

Topic label, number	Numbe	er of judgem	ents in certa	in topic	Number of judgements in certain topic			
	observed in a given year				observed in a given quarter			
	(in bracket	s: share in a	ll judgement	s in certain	(in bracket	s: share in a	ll judgement	s in certain
		yea	ar):			quai	rter):	
	2016	2017	2018	2019	Ι.	II.	III.	IV.
Consumer protection, 2								
	214	281	249	168	246	280	173	213
	(1.72%)	(2.47%)	(2.70%)	(2.48%)	(2.21%)	(2.68%)	(2.16%)	(2.07%)
Adhesion contracts, 3								
	98	110	151	160	134	155	122	108
	(0.79%)	(0.97%)	(1.64%)	(2.36%)	(1.20%)	(1.48%)	(1.52%)	(1.05%)
Nemo ad alium plus								
iuris transferre potest	192	283	239	208	260	216	227	219
quam ipse habet, 14	(1.54%)	(2.48%)	(2.59%)	(3.07%)	(2.34%)	(2.07%)	(2.83%)	(2.13%)
International transport								
of passengers, 17	77	230	98	93	89	112	146	151
	(0.62%)	(2.02%)	(1.06%)	(1.37%)	(0.80%)	(1.07%)	(1.82%)	(1.47%)
Medicine: chronić								
illnesses, 20	220	207	250	230	218	238	220	231
	(1.76%)	(1.82%)	(2.71%)	(3.40%)	(1.96%)	(2.28%)	(2.74%)	(2.25%)

 The shares of topics in all judgments issued in a given time horizon were analysed.

 The hypothesis of seasonality in the occurrence of particular topics seems to have a good chance of being confirmed in the course of further analysis.

 Next step: building more topic models – separately for each quarter and comparing the topics evolution.

^ Extract of the results obtained; presented are those topics whose share of judgements between quarters fluctuated most strongly.

Results – seasonality of appeals share

Topic label, number	Percentage of appeals against judgments on a				Topic label, number Percentage of appeals against jud				ments on a
	given topic by quarter:				given topic by quarter:				
	I.	II.	III.	IV.		l.	II.	111.	IV.
Drink-driving, 1	9.01%	10.00%	10.03%	10.29%	Copyright law, transport of passengers, 13	5.42%	5.16%	8.80%	5.67%
Consumer protection, 2	8.54%	6.07%	6.36%	9.86%	Nemo ad alium plus iuris transferre potest quam ipse habet, 14	6.15%	2.31%	2.20%	4.11%
Adhesion contracts, 3	11.94%	4.52%	1.64%	5.56%	Continuous provision of services, 15	7.98%	7.57%	8.41%	7.89%
Transport of goods, 4	8.61%	6.70%	8.39%	5.97%	Burglary, neurological diseases, construction, 16	9.06%	9.18%	8.96%	9.49%
Insanity, 5	12.87%	13.06%	12.65%	14.67%	International transport of passengers, 17	8.99%	5.36%	2.74%	4.64%
Alimony, 6	10.37%	8.82%	9.14%	8.89%	Construction, vis maior, 18	8.77%	11.51%	9.47%	11.79%
Labour law, corporate matters, 7	8.80%	6.26%	5.56%	5.07%	Medicine: mechanical injuries, 19	7.59%	12.68%	11.73%	11.37%
Infringement of physical integrity, insult, 8	12.36%	10.91%	10.70%	11.19%	Medicine: chronic illnesses, 20	7.80%	4.62%	5.45%	2.60%
Incapacitation, social security, 9	6.90%	3.68%	3.16%	8.66%	Company law, 21	5.36%	5.56%	6.77%	6.59%
Medicine: orthopaedics, 10	4.98%	8.05%	7.39%	6.28%	Vehicles issues, 22	9.80%	6.09%	7.91%	6.41%
Media, mortgages denominated in Swiss Franc, 11	8.55%	5.18%	8.75%	6.95%	Power of attorney, criminology, 23	17.61%	14.08%	12.09%	11.18%
Implementing criminal law provisions, 12	7.97%	6.12%	10.27%	9.57%	Burglary, theft, assault, 24	8.28%	13.52%	7.93%	8.33%

- The appeals share among topicassigned judgments issued in specific quarters was analysed.
- The highest shares tend to occur in the first quarters (11 subjects) and the lowest in the second quarters (3 subjects).
- In 10 out of 24 topics, the appeals share increased in the fourth quarter compared to the previous quarter.
- It appears that the hypothesis of an increasing probability of appeal in the fourth quarter will not be confirmed.

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Future work

- Iterative **upgrades and optimization** of the models.
- Trying alternative methods of choosing an optimal number of topics.
- Looking for alternative approaches for identifying "similar" and "border" topics.
- Preparing more topic models with corpus divided by: year, quarter, region, courts departments type.

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