

# Discrimination against foreigners in the patent system: Evidence from standard-essential patents

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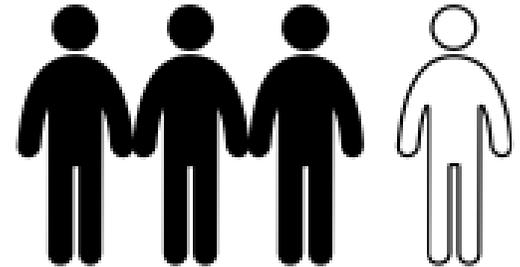
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**Where innovation starts**

# Paper in a nutshell

- Earlier studies have observed practices of discrimination at the Chinese patent office SIPO for strategic fields
- China has recognized standards to be of strategic interest
- Concerns have been expressed that discrimination extends to SEPs in terms of prosecution and enforcement
- This paper investigates differential treatment in SIPO patent prosecution and traces its sources
  - Controlling for alternative explanations using a unique identification strategy that exploits timing of SEP disclosures



Telecommunications industry as selected 'strategic' industry that the government has actively sought to nurture (Ernst, 2011)

## Phase 1: (2000s)

- Promotion of home-made standards ('indigenous' standards) and goal of incorporating mainly IP of Chinese owners
  - Examples: TD-SCDMA (3G mobile) and WAPI (wireless encryption)
- Have generally been a failure (no adoption abroad, limited adoption in China itself), despite strong government backing
- Moreover, while the goal was that such 'indigenous' standards would depend on domestic knowledge, in reality they also incorporated significant amounts of foreign IP
  - Breznitz and Murphree, 2013

## Phase 2: (2010s)

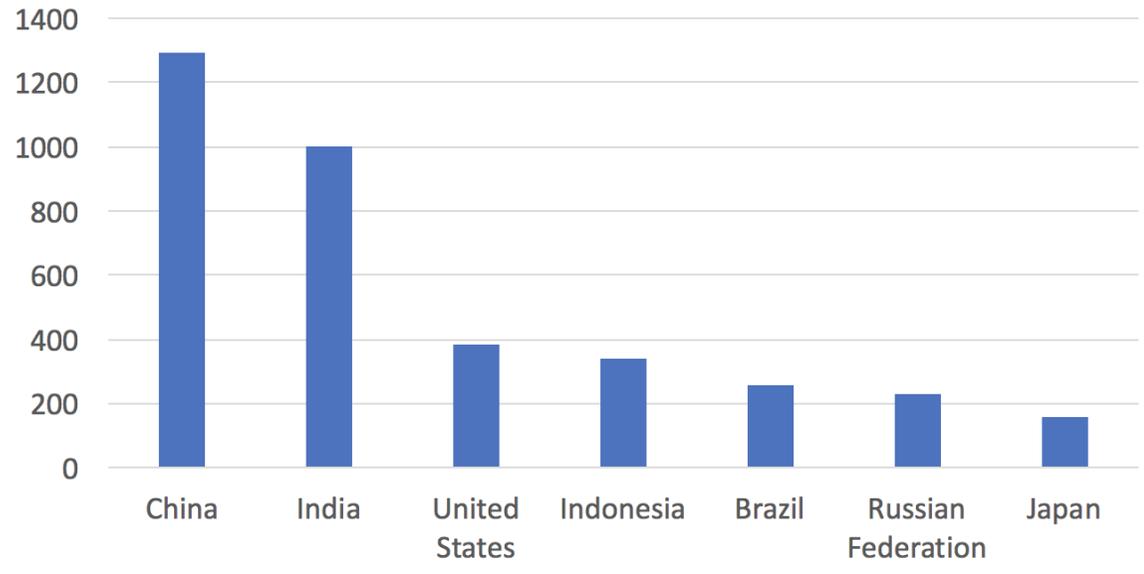
- Adopting global standards, also in China itself
- Significant success for Huawei and ZTE

## But also tension and concerns at global level:

- *“Chinese competition authorities may target for investigation foreign firms that hold [patents] that may be essential to the implementation of certain standard technologies”* (USITC, 2014: 35)
- Cases at Guangdong High Court of China and China’s National Development and Reform Commission (NDRC)
- Concerns that foreign firms have more problems obtaining patent protection in China

## China largest single market for mobile phones

Mobile subs, 2015 (millions)



Source: ITU / World Bank

## China global manufacturing powerhouse

- Patents confer exclusive right for sales, import, use, manufacturing, ...
- 'iPhone' city of Zhengzhou: Foxconn hires 350,000 workers and makes up to 500,000 iPhone devices per day

*'To affect profit flows favorably, each country wants the strongest possible protections in foreign countries, and the weakest possible protections for foreigners in its own domestic market'*

(Scotchmer 2004, p.329)

Paris Convention for the Protection of Industrial Property (1883) establishes **National Treatment principle**: each Contracting State must grant the same protection to nationals of other Contracting States that it grants to its own nationals.

- Evidence of discrimination at the Chinese patent office (SIPO) (Yang, 2008; Liegsalz and Wagner, 2013)
- Foreign firms have a particularly low probability to receive a patent grant in China for inventions in strategic fields (de Rassenfosse & Raiteri 2016)
- No study focused on SEP

This paper studies differences of patent application outcome between Chinese and foreign applications at SIPO, and searches for traces of discrimination

Important:

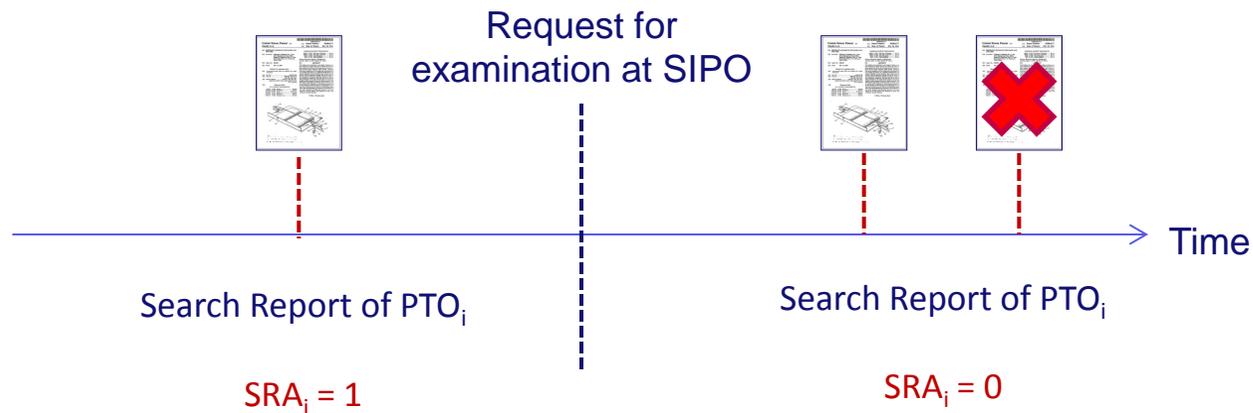
- *Different outcomes does not necessarily mean discrimination*
- *Over anything else, the outcome should be driven by the patentability of the application (novelty, inventive step, ...)*

# Econometric approach: hypothesis and identification strategy

H1

*Applications for which an earlier search report is available will have a less favorable application outcome, ceteris paribus*

-> Demonstrates differential outcome, not discrimination



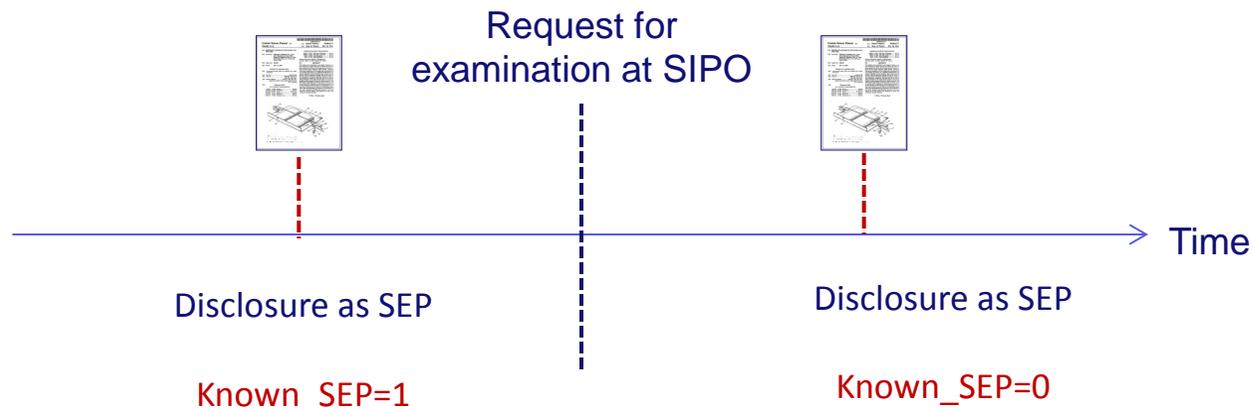
USPTO: form PTO-892 ('Notice of References Cited')  
EPO: A1 or A3 publication kind  
WO/PCT: SIPO application based on PCT route

# Econometric approach: hypothesis and identification strategy

H2

*Foreign patent applications that are known to be standard essential at the time they enter the substantive examination phase at SIPO have a less favourable examination outcome, ceteris paribus*

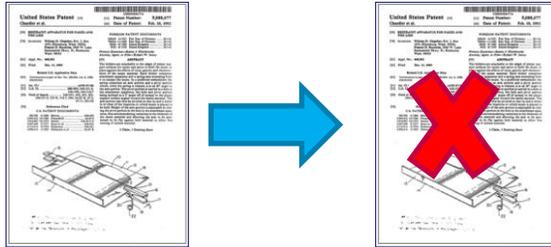
-> Demonstrates differential outcome, not discrimination



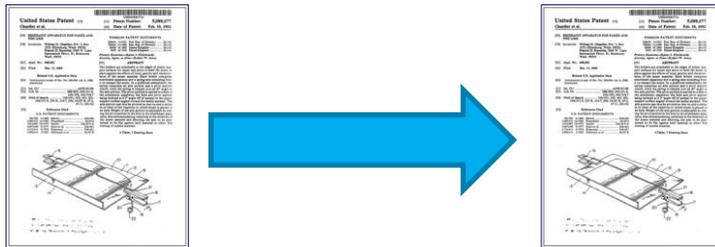
SEP disclosure date at ETSI of the patent  
(or any patent from the same INPADOC family)

# Dependent variable

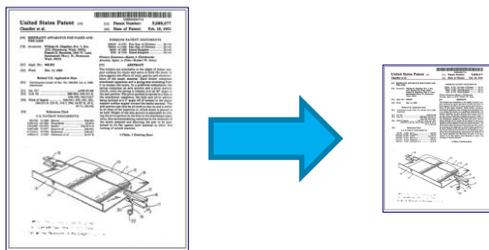
How do we measure 'a less favourable examination outcome'?



**Grant outcome:** whether a patent application was granted (OLS and Probit)



**Grant-lag:** duration of the examination process, in months (OLS and Poisson)



**Reduction in scope:** difference in the number of words per independent claim included in the granted patent and in the patent application (Yoshimi et al, 2016), (OLS)

- **Variance in quality of application**
  - Twin patent approach (Webster et al., 2014; Sampat and Shadlen, 2015; de Rassenfosse et al., 2016)
  - Variable  $PFE_i$  is invention pseudo fixed-effect that captures other patent offices' assessment of the patentability of invention<sub>*i*</sub>
- **Controls (varies per analysis)**
  - Patent attorney effects
  - Patent-level control variables: patent family size, # IPC classes, # inventors, examination-request lag, priority-declaration lag, number independent claims,  $\Delta$  independent claims
  - Firm fixed effects, year effects, ...

# Regression specification

Tests earlier availability of search reports from EPO, USPTO and PCT

H1

$$\begin{aligned} grant_i = & \beta_1 EPO\_sra_i + \beta_2 USPTO\_sra_i + \beta_3 PCT\_sra_i \\ & + \beta_4 foreign_i + \beta_5 known\_SEP_i + \beta_6 (foreign \times known\_SEP)_i \\ & + \beta_7 PFE_i + \mathbf{X}_i \gamma + \varepsilon_i \end{aligned}$$

Tests whether SEP status is known and applicant is foreign

H2

Controls for patent quality based on decision other patent offices

Vector with 10 patent-level control variables

## Data sources:

- EPO Worldwide Patent Statistical Database (PATSTAT))
- SEP disclosures: European Telecommunications Standards Institute (ETSI)
- Google Patent website and the SIPO website attorney agency and claims

## Sample:

- Focus on SEP applications related to the 3G WCDMA and 4G LTE standards that have an international direct equivalent
- Final sample: 1,653 SEP applications
  - Smaller sample for grant lag and reduced scope because this can only be measured for granted patents

## Descriptives

	Chinese applicants				Foreign applicants				t-test
	min	mean	max	sd	min	mean	max	sd	Diff.
granted	0.0	0.931	1		0.0	0.881	1		0.050*
grant_lag	4.0	25.390	71	11.927	12.0	41.676	109	14.637	-16.29*
Δ Scope	-122.0	41.861	337	60.021	-216.0	35.653	1575	68.319	6.208
known_sep	0.0	0.257	1	0.437	0.0	0.283	1	0.451	-0.026
EPO_sra	0.0	0.095	1		0.0	0.511	1		-0.416*
USPTO_sra	0.0	0.021	1		0.0	0.170	1		-0.148*
PCT_sra	0.0	0.088	1		0.0	0.607	1		-0.519*
exam_request_lag	7.0	22.513	44	7.173	3.0	26.081	63	7.329	-3.568*
nb_inv	1.0	2.423	8	1.576	0.0	2.567	13	1.546	-0.145
dec_prior_lag	4.0	38.373	140	21.531	3.0	65.705	191	37.679	-27.33*
log_fam_size	0.7	1.301	2	0.430	0.7	1.807	3	0.464	-0.506*
log_tot_IPC	0.0	0.851	2	0.461	0.0	0.963	2	0.445	-0.111*
nb_indep_claims	1.0	3.105	12	2.132	1.0	4.523	55	3.160	-1.418*
log_words_claim	3.5	4.302	6	0.352	3.2	4.048	6	0.363	0.254*
PFE	0.0	0.555	1	0.411	0.0	0.697	1	0.323	-0.141*
fast	0.0	0.172	1		0.0	0.089	1		0.083*
slow	0.0	0.039	1		0.0	0.124	1		-0.084*
<i>N</i>	421				1232				

The column t-test reports the difference between the averages of the two groups and the statistical significance of that difference.

\*  $p < 0.01$ .

	OLS					Probit				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
EPO_sra	-0.032*	-0.022			-0.022	-0.014	-0.010			-0.011
	(0.017)	(0.017)			(0.017)	(0.014)	(0.012)			(0.011)
USPTO_sra	-0.083***	-0.074**			-0.075**	-0.066***	-0.052***			-0.052***
	(0.032)	(0.031)			(0.031)	(0.020)	(0.018)			(0.017)
PCT_sra	0.332***	0.368***			0.370***	0.216***	0.207***			0.198***
	(0.027)	(0.029)			(0.030)	(0.021)	(0.023)			(0.023)
foreign			0.042	0.064	-0.012			0.042	0.055	0.000
			(0.067)	(0.068)	(0.071)			(0.048)	(0.045)	(0.031)
known_sep			0.085**	0.073**	0.044			0.113**	0.092**	0.051*
			(0.035)	(0.036)	(0.036)			(0.045)	(0.044)	(0.029)
foreign × known_sep			-0.094**	-0.106**	-0.093**			-0.123***	-0.133***	-0.088***
			(0.041)	(0.041)	(0.040)			(0.048)	(0.046)	(0.030)
exam_request_lag		-0.006***		0.001	-0.007***		-0.003***		0.001	-0.003***
		(0.001)		(0.001)	(0.002)		(0.001)		(0.001)	(0.001)
log_fam_size		-0.013		-0.021	-0.009		0.002		-0.013	0.007
		(0.019)		(0.021)	(0.019)		(0.014)		(0.020)	(0.013)
log_tot_IPC		-0.016		-0.006	-0.017		-0.021*		-0.015	-0.021*
		(0.018)		(0.019)	(0.018)		(0.012)		(0.018)	(0.011)
nb_inv		0.016***		0.022***	0.015***		0.015***		0.023***	0.015***
		(0.005)		(0.006)	(0.005)		(0.004)		(0.006)	(0.004)
dec_prior_lag		-0.000*		-0.001*	-0.001**		-0.000**		-0.001**	-0.001***
		(0.000)		(0.000)	(0.000)		(0.000)		(0.000)	(0.000)
log_NB_indep_claims		0.011		0.018	0.013		0.014		0.019	0.016*
		(0.014)		(0.015)	(0.014)		(0.009)		(0.014)	(0.008)
log_words_claim		0.045**		0.027	0.045**		0.037**		0.033	0.036**
		(0.021)		(0.023)	(0.021)		(0.015)		(0.021)	(0.014)
Fixed effects:										
PFE	0.186***	0.179***	0.237***	0.242***	0.181***	0.129***	0.111***	0.223***	0.219***	0.106***
	(0.026)	(0.027)	(0.028)	(0.030)	(0.027)	(0.019)	(0.019)	(0.023)	(0.024)	(0.018)
Firm Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Agency Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
App_Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
_cons	0.838***	1.089***	0.738***	0.705***	1.104***					
	(0.045)	(0.113)	(0.082)	(0.134)	(0.133)					
<i>N</i>	1653	1653	1653	1653	1653	1425	1425	1425	1425	1425
<i>R</i> <sup>2</sup>	0.267	0.287	0.145	0.158	0.290	.347	.383	.177	.203	0.394

Standard errors in parentheses

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Right-hand side columns report the marginal effect for the probit model

	OLS				
	(1)	(2)	(3)	(4)	(5)
EPO_sra	-0.032*	-0.022			-0.022
	(0.017)	(0.017)			(0.017)
USPTO_sra	-0.083***	-0.074**			-0.075**
	(0.032)	(0.031)			(0.031)
PCT_sra	0.332***	0.368***			0.370***
	(0.027)	(0.029)			(0.030)
foreign			0.042	0.064	-0.012
			(0.067)	(0.068)	(0.071)
known_sep			0.085**	0.073**	0.044
			(0.035)	(0.036)	(0.036)
foreign × known_sep			-0.094**	-0.106**	-0.093**
			(0.041)	(0.041)	(0.040)
exam_request_lag		-0.006***		0.001	-0.007***
		(0.001)		(0.001)	(0.002)
log_fam_size		-0.013		-0.021	-0.009
		(0.019)		(0.021)	(0.019)
log_tot_IPC		-0.016		-0.006	-0.017
		(0.018)		(0.019)	(0.018)
nb_inv		0.016***		0.022***	0.015***
		(0.005)		(0.006)	(0.005)
dec_prior_lag		-0.000*		-0.001*	-0.001**
		(0.000)		(0.000)	(0.000)
log_NB_indep_claims		0.011		0.018	0.013
		(0.014)		(0.015)	(0.014)
log_words_claim		0.045**		0.027	0.045**
		(0.021)		(0.023)	(0.021)
Fixed effects:					
PFE	0.186***	0.179***	0.237***	0.242***	0.181***
	(0.026)	(0.027)	(0.028)	(0.030)	(0.027)
Firm Effects	Yes	Yes	Yes	Yes	Yes
Agency Effects	Yes	Yes	Yes	Yes	Yes
App_Year Effects	Yes	Yes	Yes	Yes	Yes
_cons	0.838***	1.089***	0.738***	0.705***	1.104***
	(0.045)	(0.113)	(0.082)	(0.134)	(0.133)
<i>N</i>	1653	1653	1653	1653	1653
<i>R</i> <sup>2</sup>	0.267	0.287	0.145	0.158	0.290

Standard errors in parentheses

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

	OLS				
	(1)	(2)	(3)	(4)	(5)
EPO_sra	-0.032*	-0.022			-0.022
USPTO_sra	-0.083***	-0.074**			-0.075**
PCT_sra	0.332***	0.368***			0.370***
foreign			0.042	0.064	-0.012
known_sep			0.085**	0.073**	0.044
foreign × known_sep			-0.094**	-0.106**	-0.093**
exam_request_lag		-0.006***		0.001	-0.007***
log_fam_size		-0.013		-0.021	-0.009
log_tot_IPC		-0.016		-0.006	-0.017
nb_inv		0.016***		0.022***	0.015***
dec_prior_lag		-0.000*		-0.001*	-0.001**
log_NB_indep_claims		0.011		0.018	0.013
log_words_claim		0.045**		0.027	0.045**
Fixed effects:					
PFE	0.186***	0.179***	0.237***	0.242***	0.181***
Firm Effects	Yes	Yes	Yes	Yes	Yes
Agency Effects	Yes	Yes	Yes	Yes	Yes
App_Year Effects	Yes	Yes	Yes	Yes	Yes
.cons	0.838***	1.089***	0.738***	0.705***	1.104***
$R^2$	0.267	0.287	0.145	0.158	0.290

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

H1: Search Report Available:

H1

- EPO insignificant
- USPTO negative (as hypothesized)
- PCT positive (!)

H1 rejected for patent grant outcome

	OLS				
	(1)	(2)	(3)	(4)	(5)
EPO_sra	-0.032*	-0.022			-0.022
USPTO_sra	-0.083***	-0.074**			-0.075**
PCT_sra	0.332***	0.368***			0.370***
foreign			0.042	0.064	-0.012
known_sep			0.085**	0.073**	0.044
foreign × known_sep			-0.094**	-0.106**	-0.093**
exam_request_lag		-0.006***		0.001	-0.007***
log_fam_size		-0.013		-0.021	-0.009
log_tot_IPC		-0.016		-0.006	-0.017
nb_inv		0.016***		0.022***	0.015***
dec_prior_lag		-0.000*		-0.001*	-0.001**
log_NB_indep_claims		0.011		0.018	0.013
log_words_claim		0.045**		0.027	0.045**
Fixed effects:					
PFE	0.186***	0.179***	0.237**	0.242***	0.181***
Firm Effects	Yes	Yes	Yes	Yes	Yes
Agency Effects	Yes	Yes	Yes	Yes	Yes
App_Year Effects	Yes	Yes	Yes	Yes	Yes
.cons	0.838***	1.089***	0.738***	0.705***	1.104***
$R^2$	0.267	0.287	0.145	0.158	0.290

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

## H1: Search Report Available:

H1

- EPO insignificant
- USPTO negative
- PCT positive (!)

H1 rejected for patent grant outcome

## H2: Known foreign SEP

H2

- negative effect (between 8.8 and 9.3 percentage points)

H2 accepted for patent grant outcome

	OLS				
	(1)	(2)	(3)	(4)	(5)
EPO_sra	-0.032*	-0.022			-0.022
USPTO_sra	-0.083***	-0.074**			-0.075**
PCT_sra	0.332***	0.368***			0.370***
foreign			0.042	0.064	-0.012
known_sep			0.085**	0.073**	0.044
foreign × known_sep			-0.094**	-0.106**	-0.093**
exam_request_lag		-0.006***		0.001	-0.007***
log_fam_size		-0.013		-0.021	-0.009
log_tot_IPC		-0.016		-0.006	-0.017
nb_inv		0.016***		0.022***	0.015***
dec_prior_lag		-0.000*		-0.001*	-0.001**
log_NB_indep_claims		0.011		0.018	0.013
log_words_claim		0.045**		0.027	0.045**
Fixed effects:					
PFE	0.186***	0.179***	0.237***	0.242***	0.181***
Firm Effects	Yes	Yes	Yes	Yes	Yes
Agency Effects	Yes	Yes	Yes	Yes	Yes
App_Year Effects	Yes	Yes	Yes	Yes	Yes
.cons	0.838***	1.089***	0.738***	0.705***	1.104***
$R^2$	0.267	0.287	0.145	0.158	0.290

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

H1: Search Report Available :

H1

- EPO insignificant
- USPTO negative
- PCT positive (!)

H1 rejected for patent grant outcome

H2: Known foreign SEP

H2

- negative effect (between 8.8 and 9.3 percentage points)

H2 accepted for patent grant outcome

All robust when considering both hypothesis at the same time

H1

Applications for which an earlier search report is available will have a less favorable application outcome, ceteris paribus.

Grant outcome (-) mixed findings: accepted for USPTO, rejected for others

Grant lag (-)

Reduction in scope (-) effect only found for PCT, not other PTOs

H2

Foreign patent applications that are known to be standard essential at the time they enter the substantive examination phase at SIPO have a less favourable examination outcome, ceteris paribus.

Grant outcome (+) strong support, between 8.8 and 9.3 percentage points

Grant lag (+) strong support

Reduction in scope (+) strong support, independent claims increases  
13.4 words on average

- What is the underlying **mechanism**?
  - Is it a 'policy' at the SIPO, driven by industrial policy?
  - Is it individual SIPO examiners that are tougher on foreign applicants when they observe the patent under examination is a SEP?
  - Is it (Chinese) companies that provide SIPO examiners with additional prior art references in case of foreign SEPs?
    - Given the bitter legal battle between Chinese companies ZTE and Huawei over SEPs in Germany, one would expect these firms to be even more active trying to prevent their domestic competitors to obtain SEPs
- Is the timing of ETSI disclosure **exogenous**, as we suggest?
  - There is a strong incentive to disclose early to signal a large portfolio, in order to negotiate favorable licensing contracts
  - Over time, the lag between application and disclosure has decreased (Bekkers et al 2017, NBER WP 23627)

# Main findings

- We find evidence that the outcomes for foreign applications of essential patents are less favorable than those for domestic, Chinese applicants
- Our findings suggest that China breaches the national treatment principle, one of the pillar of the international patent system
- Our findings have considerable implications, as China is not only one of the world's largest markets for products based on technical standards, but also a country where many of such products are manufactured for other markets

# Thank you!

Full paper is available at SSRN, Paper No. 3007699