

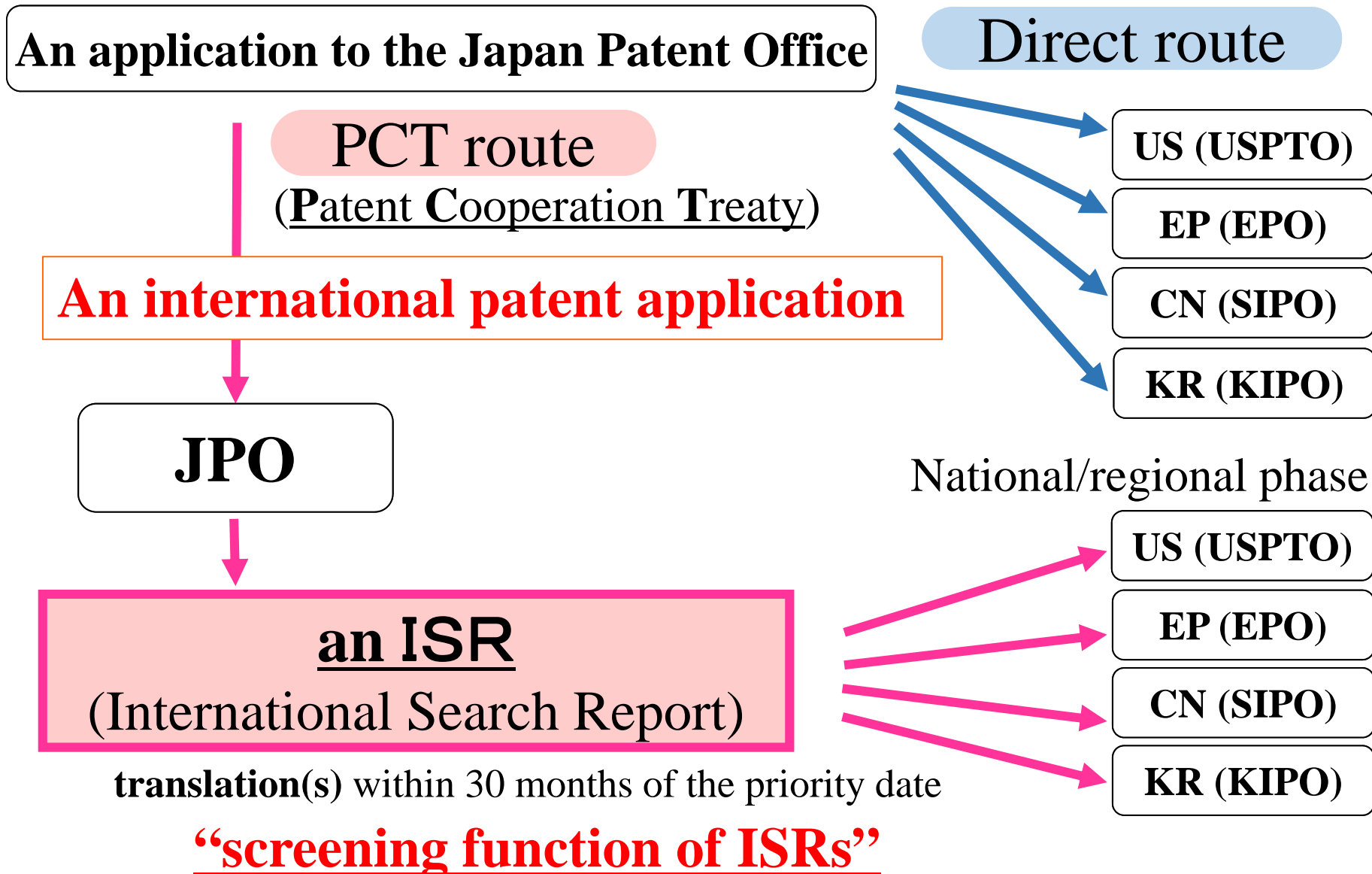
The screening function of International Search
Reports: Evidence from 1999 Examination Policy
Change by the Japan Patent Office

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Institutional Background (1)

Two ways to obtain foreign patents



Institutional Background (2)

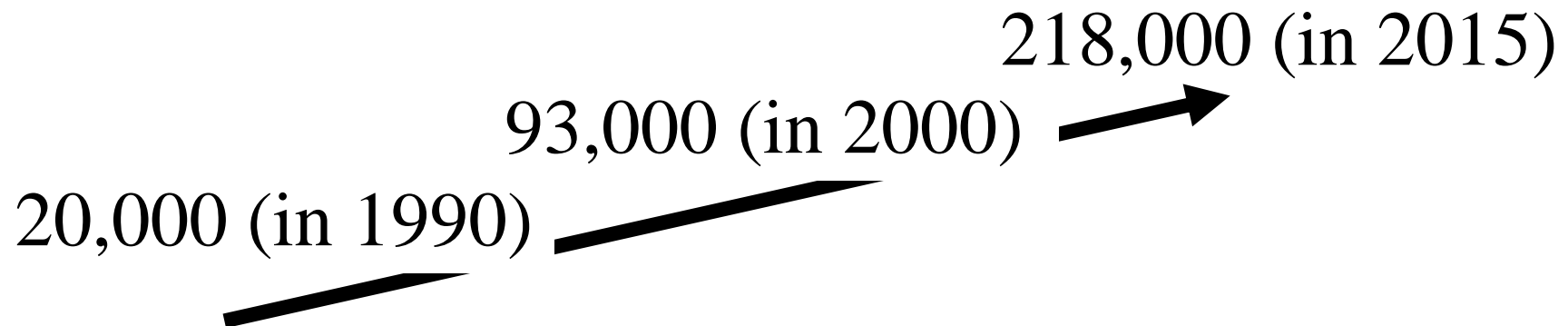
An example of an ISR, WO01/66998 A1

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP, 57-210211, A (Matsushita Electric Ind. Co., Ltd.), 23 December, 1982 (23.12.82), page 2, upper left column, line 15 to lower left column, line 8 (Family: none)	1,5
Y	JP, 50-9843, U1 (DOWA MINING CO., LTD.), 31 January, 1975 (31.01.75), Claims of Utility Model	2,4,6,7,8
Y	JP, 57-46246, U (Yoshio NIWA), 15 March, 1982 (15.03.82), Claims of Utility Model	2,6,7
A	JP, 53-32429, A (Showa Tekko K.K.), 27 March, 1978 (27.03.78), Claims (Family: none)	2,6
A	US, 5099802, A (Forschungszentrum Julich Gmbh.), 31 March, 1992 (31.03.92) & US, 5002481, A & US, 5054546, A	3
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		

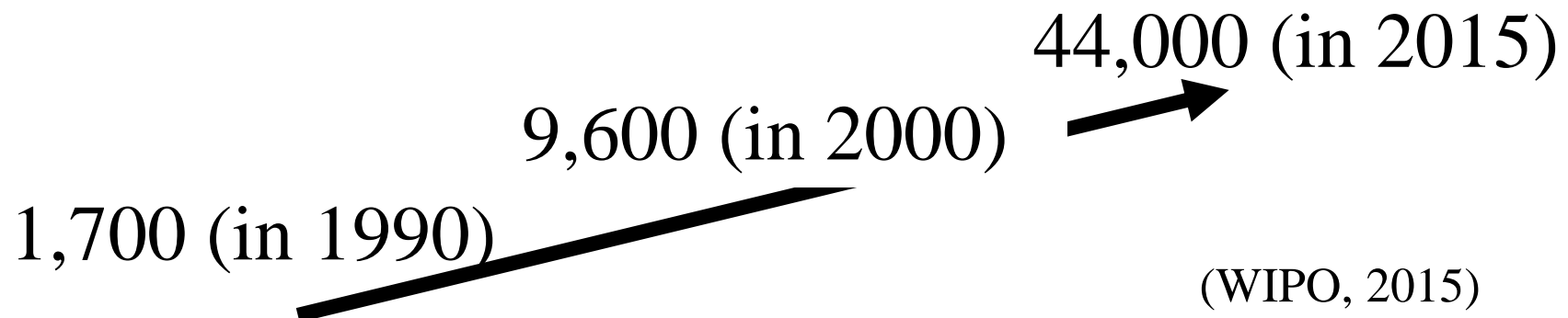
Institutional Background (3)

ISRs' screening function is becoming more and more important as the number of PCT applications increases.

- The total number of PCT applications filed globally



- PCT applications filed by Japanese residents



(WIPO, 2015)

Policy Background

More focus on quality of patent examinations

Concerns that low-quality patents hinder innovation

(FTC(2003); Jaffe and Lerner. (2004); National Academies (2004); Lemley and Shapiro (2005); Farrell and Shapiro (2008), Bessen and Meurer (2008); GAO(2013)).

High quality examinations -top priority tasks for PO's

EPO 2013 the Economic and Scientific Advisory Board Report

Japan 2014 Cabinet decision toward the highest quality examination

US 2015 USPTO: Enhanced Patent Quality Initiative

2016 GAO: PTO define quality and strengthen search capabilities.

Prior literature (1)

Trilateral Patent Offices (the EPO, JPO, and USPTO) (2001, 2002) investigated the utility of ISRs.

They confirmed that ISRs are beneficial to patent authorities that examine PCT patent applications that entered the national/regional phase, although the details are not publicly available.

The JPO (2011, 2013) has investigated the types and number of prior art documents cited by national/regional patent offices (3,597 ISRs prepared by the JPO and 5,311 ISRs prepared by the USPTO).

It has revealed that a significant amount of prior art documents are added through the national/regional examination process in each designated country.

Prior literature (2)

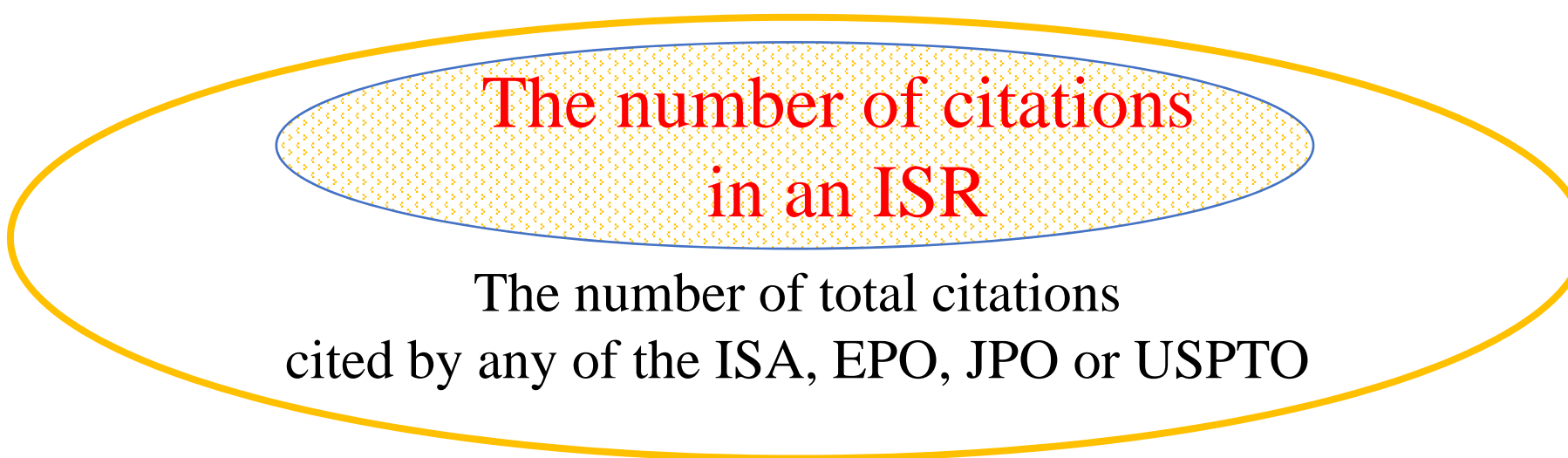
Wada (2016) has scrutinized a large sample of PCT applications with filing dates in 2002–2005 of which ISRs were prepared by the EPO, JPO, or USPTO and entered the three national/regional examination procedures.

It has revealed that geographical distance as well as the technological complexity of the filed inventions negatively affect the probability of finding prior art patent documents.

Prior literature (3)

It has been proposed to quantify the quality of an ISR by the ratio of the number of references cited in the ISR to the number of entire citations cited by any of the ISA, EPO, JPO, or USPTO (Wada, 2014).

$$\text{ISR Quality indicator} = \frac{\text{The number of ISR citations}}{\text{The number of total citations}}$$



The diagram illustrates the components of the ISR Quality indicator formula. It features a large yellow oval containing two smaller elements. At the top is a blue oval with a yellow dotted background, containing the text 'The number of citations in an ISR' in red. Below this is the text 'The number of total citations cited by any of the ISA, EPO, JPO or USPTO' in black.

**The number of citations
in an ISR**

The number of total citations
cited by any of the ISA, EPO, JPO or USPTO

Research Objectives

In summary, despite the importance of an ISR's screening function, **NO** prior study has thus far addressed this matter or has shown the effects of improving prior art search on examination outcomes empirically.

Research questions:

- Are ISRs useful to applicants?
- Does improving the information provided by an ISR affect the applicant's decision to enter national/regional phase procedures?
If yes, to what extent?

Difficulties to address the RQ

1. No established way of measuring the quality of an ISR

Δq detected by ΔNum_X_doc or ΔNum_XY_doc

2. **An endogeneity problem** with respect to the **economic value** of the invention (economic value obtainable by patenting the focal invention in the designated country)

The number of the examiner's backward citations is positively correlated with the economic value of the focal invention (Allison et al., 2003; Harhoff et al., 2003), which gives positive bias to the effect estimated by the OLS method, on the applicant's decision to enter national phases.

Unexpected drastic policy change by the JPO in 1999

1997 Dec. – “FA12 policy” Quantity-oriented

First action within 12 months of the request for examination.

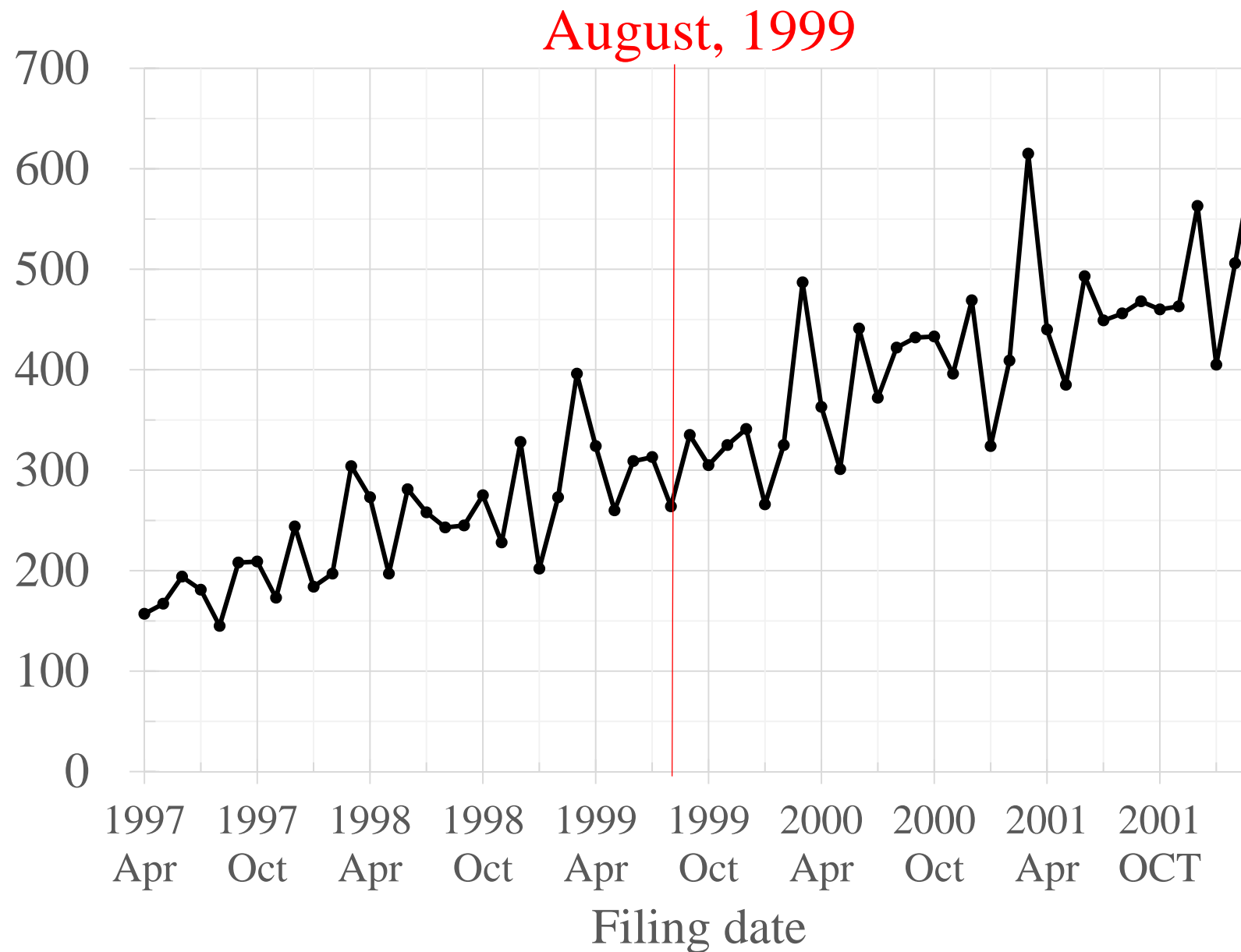
Around August, 1999

Unexpected drastic policy change
from “Quantity oriented” to “Quality oriented”

2000 Jan: Quality-oriented (Ihii, 2000; Ogiya 2000)

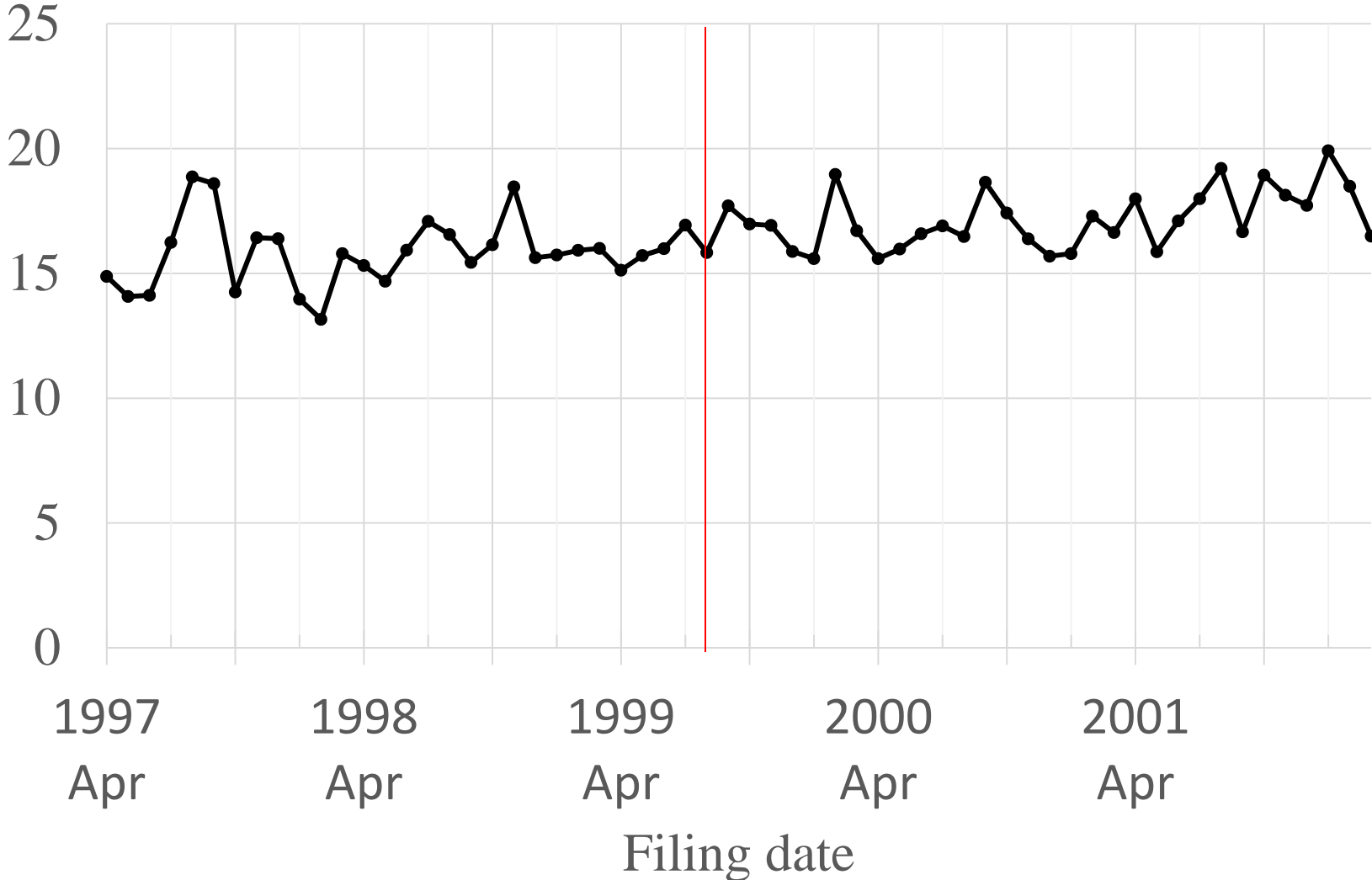
“Quality comparable to those of foreign patent offices”

Transition of PCT applications



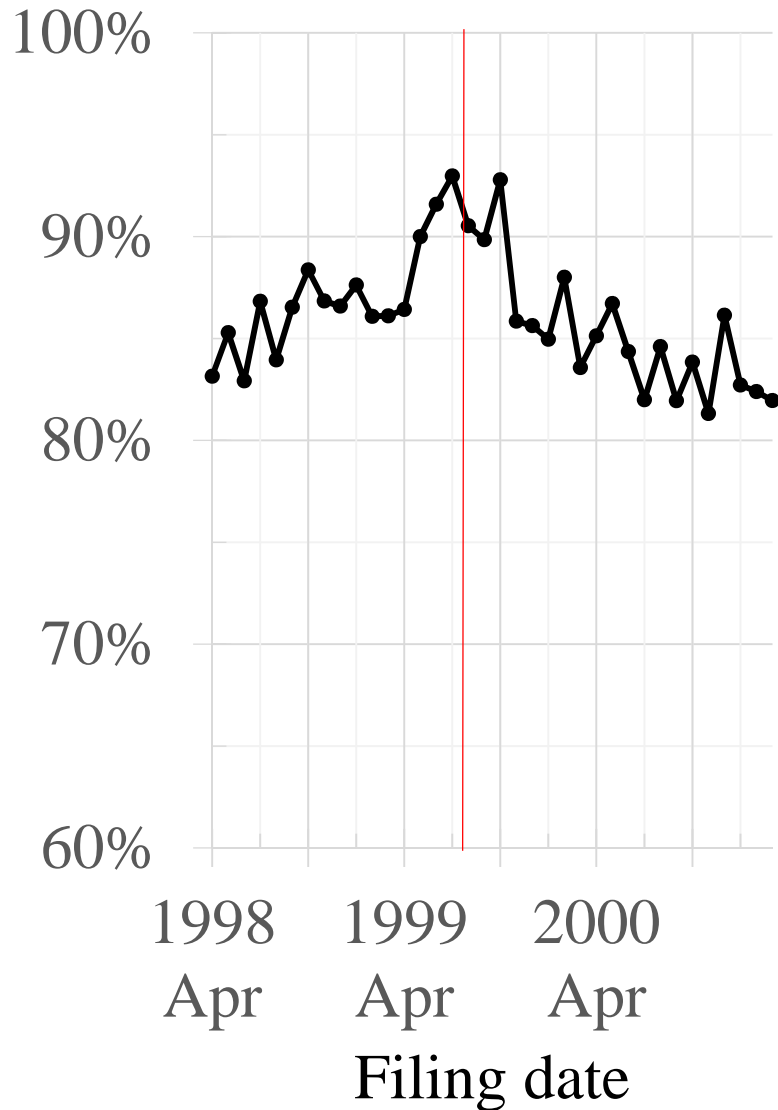
Characteristics of PCT applications

Num_claims
(mean)

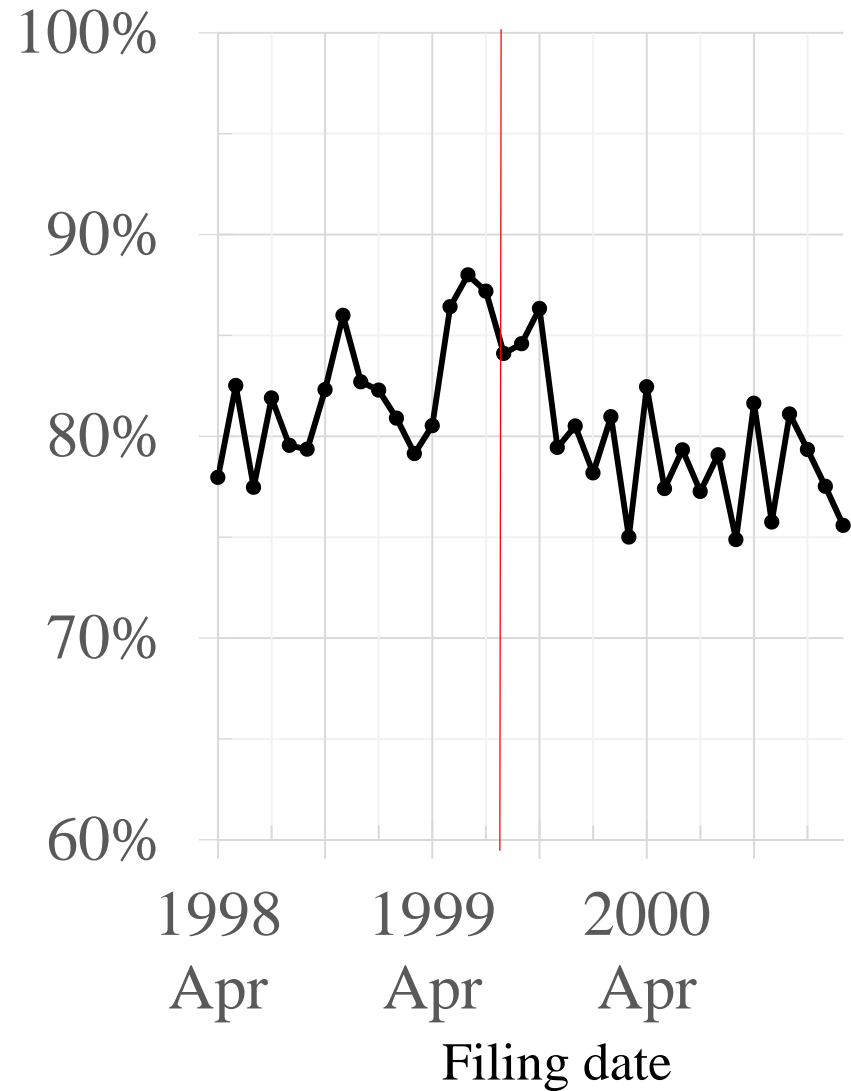


Rate of entering national/regional phases

US entering rate



EP entering rate



An outline of the method

- There was an unexpected drastic patent examination policy change from quantity-oriented to quality-oriented by the JPO in 1999.
- The policy change significantly increased the number of references cited in ISRs.
- The quality of an ISR is quantified by the number of XY documents (documents that deny the novelty or inventive step of at least one of the claims).
- Use the drastic policy change as an instrumental variable for the quality improvement of ISRs.
- Fortunately, the policy change of the JPO was NOT announced in advance and was NOT well publicized even afterward. The change did not affect the quality of applications immediately after the change.

Data construction

Database used

- PATSTAT (2015 AUTUM version, EPO)
- PCT-Bibliographic DB (WIPO) (designated country)
- PATENTSCOPE (WIPO) (Number of claims, US entrance)

Data: PCT applications written in Japanese and the ISR of which the JPO produced

Filing date : FY1998 to FY2000 (Apr 1998 – Mar 2001)

Removed applications

- Applications claiming no priority
- Applications of co-ownership
- Applicants who filed less than 10 applications in the above period

Hypotheses

Hypothesis H1: Improving the quality of prior art information provided by ISRs significantly reduced the rate of applicants' decision to enter the national/regional phase.

> *The 2nd stage of IV*

Sub hypothesis H1a: JPO's 1999 patent examination policy change significantly increased the numbers of such kind of citations cited in ISRs as 1) XY documents, 2) X documents, 3) foreign patent documents that have no patent families written in Japanese, and 4) NPL documents.

> *The 1st stage of IV*

Sub hypothesis H1b: The rate of entering the US national phase or EP regional phase significantly declined after JPO's policy change in 1999. > *Reduced form*

Variables

Variables	Definitions
<i>US_enter_dummy</i>	1 if the application entered US national phase; otherwise, 0
<i>EP_enter_dummy</i>	1 if the application entered EP regional phase; otherwise, 0
<i>policy_change_dummy</i>	0 if filed before August 1999; 1 if filed in and after August 1999.
<i>ln_Num_XY_doc</i>	$\ln(\text{the number XY documents} + 1)$
<i>ln_Num_X_doc</i>	$\ln(\text{the number X documents} + 1)$
<i>ln_Num_F_Pat</i>	$\ln(\text{the number of foreign patent documents with no JP family})$
<i>ln_Num_NPL</i>	$\ln(\text{the number of NPL documents} + 1)$
<i>ln_Num_priority</i>	$\ln(\text{the number of applications for which the priority are claimed})$
<i>ln_Num_claims</i>	$\ln(\text{the number of claims})$
<i>ln_Num_inventors</i>	$\ln(\text{the number of inventors})$
<i>fiscal_year_dummy</i>	FY: April to March in the following year, baseline: FY1999
<i>tech_dummy</i>	Technology fields are divided into 35 categories
<i>applicant_dummy</i>	Based on DOCDB standard name ids in the PATSTAT DB

1st stage of IV estimations

$\ln_Num_X_doc_{it}$

(or $\ln_Num_XY_doc_{it}$, $\ln_Num_F_Pat_{it}$,
 $\ln_Num_ln_NPL_{it}$)

= β_0 *policy_change_dummy*

+ β_1 $\ln_Num_priority_{it}$

+ β_2 $\ln_Num_claims_{it}$

+ β_3 $\ln_Num_inventors_{it}$

+ β_{year} *fiscal_year_dummies*

+ β_{tech} *tehnology_dummies*

+ $\beta_{year,tech}$ *fiscal_year_dummies* × *tehnology_dummies*

+ β_k *applicant_dummies* + *constant* + ε

1st stage estimations

Explained variable	<i>ln_Num_X</i>	<i>ln_Num_XY</i>	<i>ln_Num_F_Pat</i>	<i>ln_Num_NPL</i>
	(1)	(2)	(3)	(4)
<i>PolicyChange_dummy</i>	.0847*** (.0223)	.0802*** (.0244)	.0315*** (.00771)	.0507*** (.0133)
<i>ln_Num_priority</i>	.0786*** (.0145)	.110*** (.0178)	.0072 (.00592)	.0125 (.00978)
<i>ln_Num_claims</i>	.102*** (.00951)	.154*** (.0157)	.0058** (.00288)	.0350*** (.00840)
<i>ln_Num_inventors</i>	.0340*** (.00959)	.0464*** (.0131)	.00518 (.00343)	-.00433 (.008)
<i>fiscal1998_dummy</i>	.0256 (.0494)	-.0316 (.106)	-.0192 (.0117)	.0319* (.0173)
<i>fiscal2000_dummy</i>	.0738 (.0477)	.0747 (.0595)	-.00158 (.0121)	.0597** (.0294)
<i>tech35_dummies</i>	yes	yes	yes	yes
<i>fiscal_dum*tech35_dum</i>	yes	yes	yes	yes
applicant	FE	FE	FE	FE
Observations	12,030	12,030	12,030	12,030
R-squared	.0505	.061	.0313	.132
Number of person_id	251	251	251	251

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.10

Descriptive statistics for data used in regression analyses

3A PCT patent applications that designates US

N = 12,030	mean	sd	p50	min	p5	p95	max
<i>US_enter_dummy</i>	0.856	0.351	1	0	0	1	1
<i>ln_Num_XY_doc</i>	0.995	0.810	1.10	0	0	2.20	4.16
<i>ln_Num_X_doc</i>	0.504	0.640	0	0	0	1.79	4.16
<i>ln_Num_F_Pat</i>	0.063	0.225	0	0	0	0.69	2.08
<i>ln_Num_NPL</i>	0.200	0.476	0	0	0	1.39	3.50
<i>ln_Num_priority</i>	0.287	0.488	0	0	0	1.39	3.14
<i>ln_Num_claims</i>	2.488	0.790	2.48	0	1.10	3.78	5.98
<i>ln_Num_inventors</i>	1.003	0.619	1.10	0	0	1.95	3.09

3B PCT patent applications that designates EP

N = 11,045	mean	sd	p50	min	p5	p95	max
<i>EP_enter_dummy</i>	0.802	0.398	1	0	0	1	1
<i>ln_Num_XY_doc</i>	0.993	0.812	1.10	0	0	2.20	4.16
<i>ln_Num_X_doc</i>	0.505	0.643	0	0	0	1.79	4.16
<i>ln_Num_F_Pat</i>	0.065	0.229	0	0	0	0.69	2.08
<i>ln_Num_NPL</i>	0.208	0.484	0	0	0	1.39	3.50
<i>ln_Num_priority</i>	0.294	0.494	0	0	0	1.39	3.14
<i>ln_Num_claims</i>	2.499	0.788	2.48	0	1.10	3.78	5.98
<i>ln_Num_inventors</i>	1.027	0.612	1.10	0	0	1.95	3.09

Reduced form estimations

US_enter_dummy_{it}

(or *EP_enter_dummy_{it}*)

= β_0 *policy_change_dummy*

+ β_1 *ln_Num_priority_{it}*

+ β_2 *ln_Num_claims_{it}*

+ β_3 *ln_Num_inventors_{it}*

+ β_{year} *filing_year_dummies*

+ β_{tech} *tehnology_dummies*

+ $\beta_{year,tech}$ *filing_year_dummies* × *tehnology_dummies*

+ β_k *applicant_dummies* + *constant* + ε

Policy change effect on entering US/EP national phase

	(1)	(2)
	<i>US_enter_dummy</i>	<i>EP_enter_dummy</i>
<i>PolicyChange_dummy</i>	-.0381***	-.0532***
	(.0109)	(.0133)
<i>ln_Num_priority</i>	.0203***	.0275***
	(.00711)	(.00933)
<i>ln_Num_claims</i>	.0273***	.0304***
	(.00623)	(.00734)
<i>ln_Num_inventors</i>	.0124**	.0253***
	(.00624)	(.00796)
<i>fiscal1998_dummy</i>	-.0681**	-.0620
	(.0343)	(.0472)
<i>fiscal2000_dummy</i>	-.0455	-.103*
	(.0295)	(.0530)
<i>tech35_dummies</i>	yes	yes
<i>fiscal_dummies * tech35_dummies</i>	yes	yes
<i>applicant</i>	FE	FE
Observations	12,030	11,045
R-squared	.0297	.0312
Number of applicants	251	240

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.10

2nd stage of IV estimations

$$\begin{aligned} & US_enter_dummy_{it} \text{ (or } EP_enter_dummy_{it}\text{)} \\ = & \beta_0 q_{it} \\ & + \beta_1 \ln_Num_priority_{it} \\ & + \beta_2 \ln_Num_claims_{it} \quad \text{an omitted variable} \\ & + \beta_3 \ln_Num_inventors_{it} \quad (+ \beta_4 Value_{it}) \\ & + \beta_{year} \text{ fiscal_year_dummies} \\ & + \beta_{tech} \text{ tehnology_dummies} \\ & + \beta_{year,tech} \text{ fiscal_year_dummies} \times \text{tehnology_dummies} \\ & + \beta_k \text{ applicant_dummies} + \text{constant} + \varepsilon \end{aligned}$$

$\Delta q \propto \Delta Num_X_doc$ or ΔNum_XY_doc

Proxies for q : \ln_Num_XY , \ln_Num_X

The instrumental variable for q : $policy_change_dummy$

Summary results of IV estimation (US)

	Explained variable: <i>US_enter_dummy</i>					
	(1)	(2)	(3)	(4)	(5)	(6)
Explanatory variables	IV 2nd stage	IV 1st stage	OLS	IV 2nd stage	IV 1st stage	OLS
<i>ln_Num_XY</i>	-.475**		-.0272***			
	(.210)		(.00585)			
<i>ln_Num_X</i>				-.449**		-.0246***
				(.175)		(.00671)
<i>PolicyChange_dummy</i>		.0802***			.0847***	
		(.0244)			(.0223)	
<i>ln_Num_priority</i>	.0725***	.110***	.0236***	.0556***	.0786***	.0225***
	(.0253)	(.0178)	(.00705)	(.0165)	(.0145)	(.00702)
<i>ln_Num_claims</i>	.101***	.154***	.0313***	.0732***	.102***	.0296***
	(.0333)	(.0157)	(.00608)	(.0189)	(.00951)	(.00609)
<i>ln_Num_inventors</i>	.0344***	.0464***	.0139**	.0277***	.0340***	.0135**
	(.0127)	(.0131)	(.00612)	(.00932)	(.00959)	(.00624)
<i>fiscal1998_dummy</i>	-.0831*	-.0316	-.0439	-.0566	.0256	-.0423
	(.0497)	(.106)	(.0334)	(.0409)	(.0494)	(.0330)
<i>fiscal2000_dummy</i>	-.0100	.0747	-.0540*	-.0124	.0738	-.0542*
	(.0459)	(.0595)	(.0308)	(.0399)	(.0477)	(.0307)
<i>tech35_dummies</i>	yes	yes	yes	yes	yes	yes
<i>fiscal*tech35</i>	yes	yes	yes	yes	yes	yes
<i>applicant</i>	FE	FE	FE	FE	FE	FE
Observations	11,045	11,045	11,045	11,045	11,045	11,045
R-squared		.0610	.0329		.0505	.0310
Number of applicants	240	240	240	240	240	240

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.10

Summary results of IV estimation (EP)

	Explained variable: <i>EP_enter_dummy</i>					
	(7)	(8)	(9)	(10)	(11)	(12)
Explanatory variables	IV 2nd stage	IV 1st stage	OLS	IV 2nd stage	IV 1st stage	OLS
<i>ln_Num_XY</i>	-.690**		-.0341***			
	(.300)		(.00601)			
<i>ln_Num_X</i>				-.666***		-.0301***
				(.247)		(.00668)
<i>PolicyChange_dummy</i>		.0771***			.0799***	
		(.0255)			(.0225)	
<i>ln_Num_priority</i>	.106***	.113***	.0316***	.0830***	.0834***	.0303***
	(.0369)	(.0182)	(.00916)	(.0240)	(.0150)	(.00930)
<i>ln_Num_claims</i>	.137***	.155***	.0353***	.0996***	.104***	.0331***
	(.0477)	(.0148)	(.00692)	(.0272)	(.0103)	(.00711)
<i>ln_Num_inventors</i>	.0465***	.0308**	.0266***	.0456***	.0305***	.0265***
	(.0147)	(.0156)	(.00793)	(.0124)	(.00948)	(.00801)
<i>fiscal1998_dummy</i>	-.0972	-.0509	-.0301	-.0663	-.00637	-.0284
	(.0707)	(.115)	(.0450)	(.0564)	(.0520)	(.0436)
<i>fiscal2000_dummy</i>	-.0609	.0611	-.117**	-.0481	.0826*	-.117**
	(.0620)	(.0732)	(.0553)	(.0551)	(.0486)	(.0547)
<i>tech35_dummies</i>	yes	yes	yes	yes	yes	yes
<i>fiscal*tech35</i>	yes	yes	yes	yes	yes	yes
<i>applicant</i>	FE	FE	FE	FE	FE	FE
Observations	11,045	11,045	11,045	11,045	11,045	11,045
R-squared		.0597	.0349		.0538	.0323
Number of applicants	240	240	240	240	240	240

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.10

Conclusions

- The JPO's 1999 unexpected drastic examination policy change significantly increased the quality of ISRs.
- This exogenous shock to applicants led to drops in national/regional phase entrance: a 4% decrease for US and a 5% decline for EP.
- Improving the quality of the ISR significantly affected the applicant's decision to enter the national/regional phase: a 10% increase in quality causes a 4-5% decrease in the entrance of US national phase and a 7% decrease in the entrance of EP regional phase.
- the JPO's policy change in 1999 made information provided by ISRs become more useful to the applicants, enhancing the screening function of ISRs and thereby contributed to raising the efficiency of the global patent examination system.

Implication

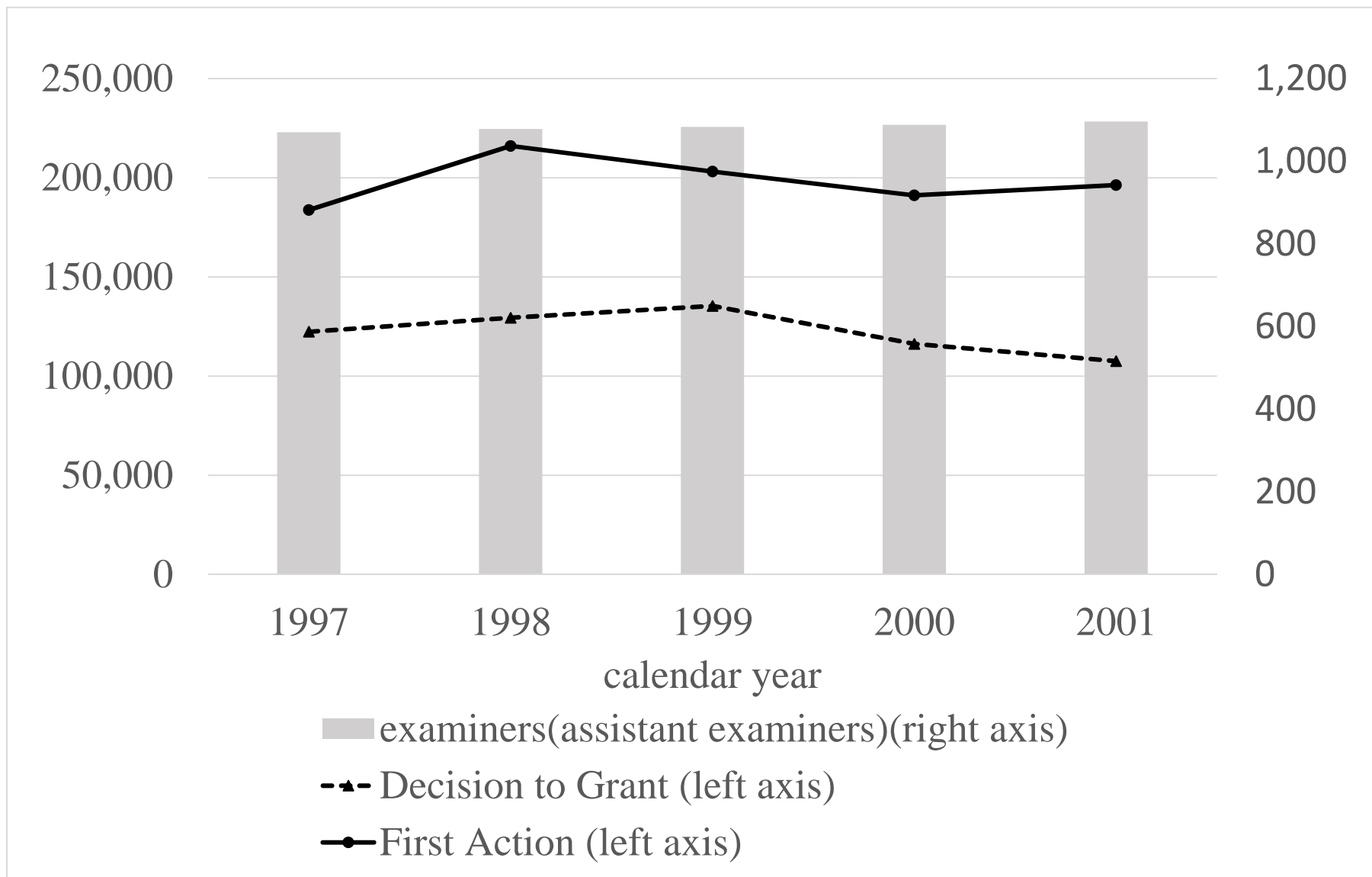
The rate of entering the national/regional phase is a potentially valuable indicator for the quality of ISRs, complementing existing indicators.

No method of measuring the quality of search has been established thus far, in spite of increasing demand for ones that can be used for such purposes as managing the operations of patent offices, enhancing policy making, and promoting international cooperation among patent authorities (Kappos & Graham, 2012; US Government Accountability Office, 2016a, 2016b)

Thank you!

Appendix

The number of examiners, first actions, and grant decisions



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