The Impact of International Patent Systems: Evidence from Accession to the European Patent Convention

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Motivation

- There are **no 'international patents'**
- Patents are national (property) rights, only valid in jurisdiction in which granted

- **What is the effect of the national character of patents?**
- Policy relevance: PCT, Unitary Patent, regional patent systems

- We study effect of accession to **European regional patent system**

- Accession by mostly middle-income economies (2005 GDP per capita US$14,400 for accession countries vs US$33,800 for existing members)

Patent systems

- Apply at national office, if passes examination, patent granted and valid only in jurisdiction where granted.
- Implication: countries individually determine important aspects of their IP rights systems

- International agreements:
  - **TRIPS** regulates and harmonizes national IP systems
  - **Paris Convention** facilitates patenting in multiple jurisdictions (priority right)
  - **Patent Cooperation Treaty** (PCT) facilitates patenting in multiple jurisdictions through single application (WIPO)

- Regional patent systems (**EPO**, ARIPO, OAPI, EAPO)

European Patent Convention (EPC)

- Created in 1977 with 7 countries (now 38)
- Single application to the EPO:
  - Application designates states in which patent may be validated.
  - Patents examined and granted by EPO.
  - **After grant**, must be **validated** in every state in which coverage is desired.
  - Enforcement at national courts.
  - In principle, lower cost than applying at each national office.

EPC
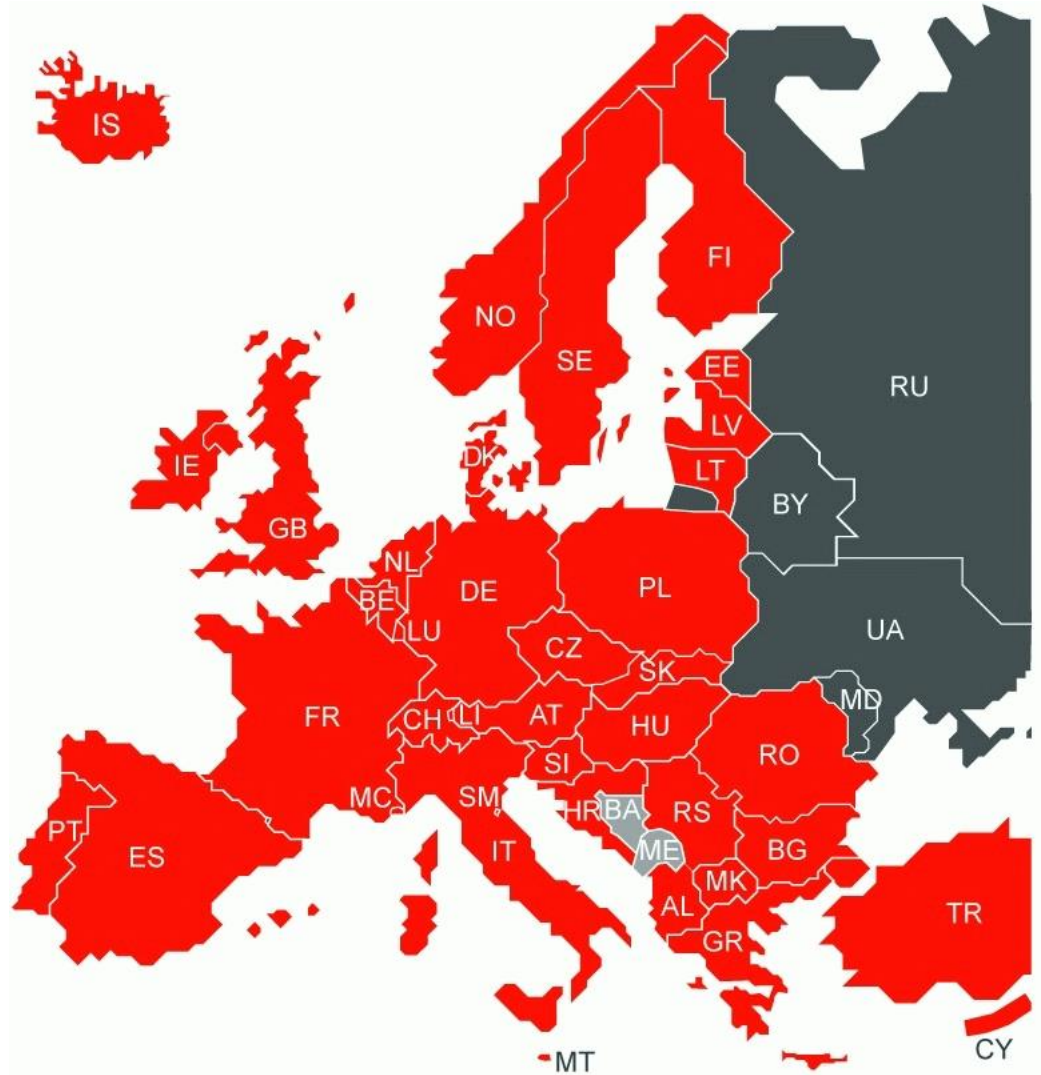
Accession to the EPC

- In most cases accession to the EPC triggered by accession to the EU

Country	EPC Extension Date	EPC Accession Date	EU Accession Year	GDP in 2005*	GDP per capita*
Bulgaria		1-Jul-2002	2007	74,896	9,678
Croatia	1-Apr-2004	1-Jan-2008	2013	63,820	14,367
Czech Republic		1-Jul-2002	2004	208,287	20,379
Estonia		1-Jul-2002	2004	20,658	15,349
Hungary		1-Jan-2003	2004	161,505	16,011
Iceland		1-Nov-2004		9,404	31,690
Latvia	1-May-1995	1-Jul-2005	2004	28,311	12,280
Lithuania	5-Jul-1994	1-Dec-2004	2004	46,682	13,667
Norway		1-Jan-2008		287,147	62,109
Poland		1-Mar-2004	2004	511,949	13,414
Romania	15-Oct-1996	1-Mar-2003	2007	200,192	9,195
Slovakia		1-Jul-2002	2004	82,222	15,183
Slovenia	1-Mar-1994	1-Dec-2002	2004	44,191	22,073
Turkey		1-Nov-2000		755,490	11,087

*Output-based GDP in 2005 US dollars, at PPP.

Source: Penn World Tables, Version 8.1

Note: grey shaded areas indicate country is European Union (EU) member

Accession to the EPC

Predicting Accession to the EPC
Cox hazard rate regression for accession

	Coefficient	Standard error	Clustered s.e.
Lagged log(population)	0.125	(0.261)	(0.233)
Lagged log(real GDP/pop)	-0.388	(1.054)	(1.070)
Lagged log(patent apps/pop)	-0.037	(0.339)	(0.343)
Chi-squared (deg of freedom)		1.39 (3)	3.85 (3)

119 annual observations on 14 accession countries.

Patent applications are filings at the national patent office

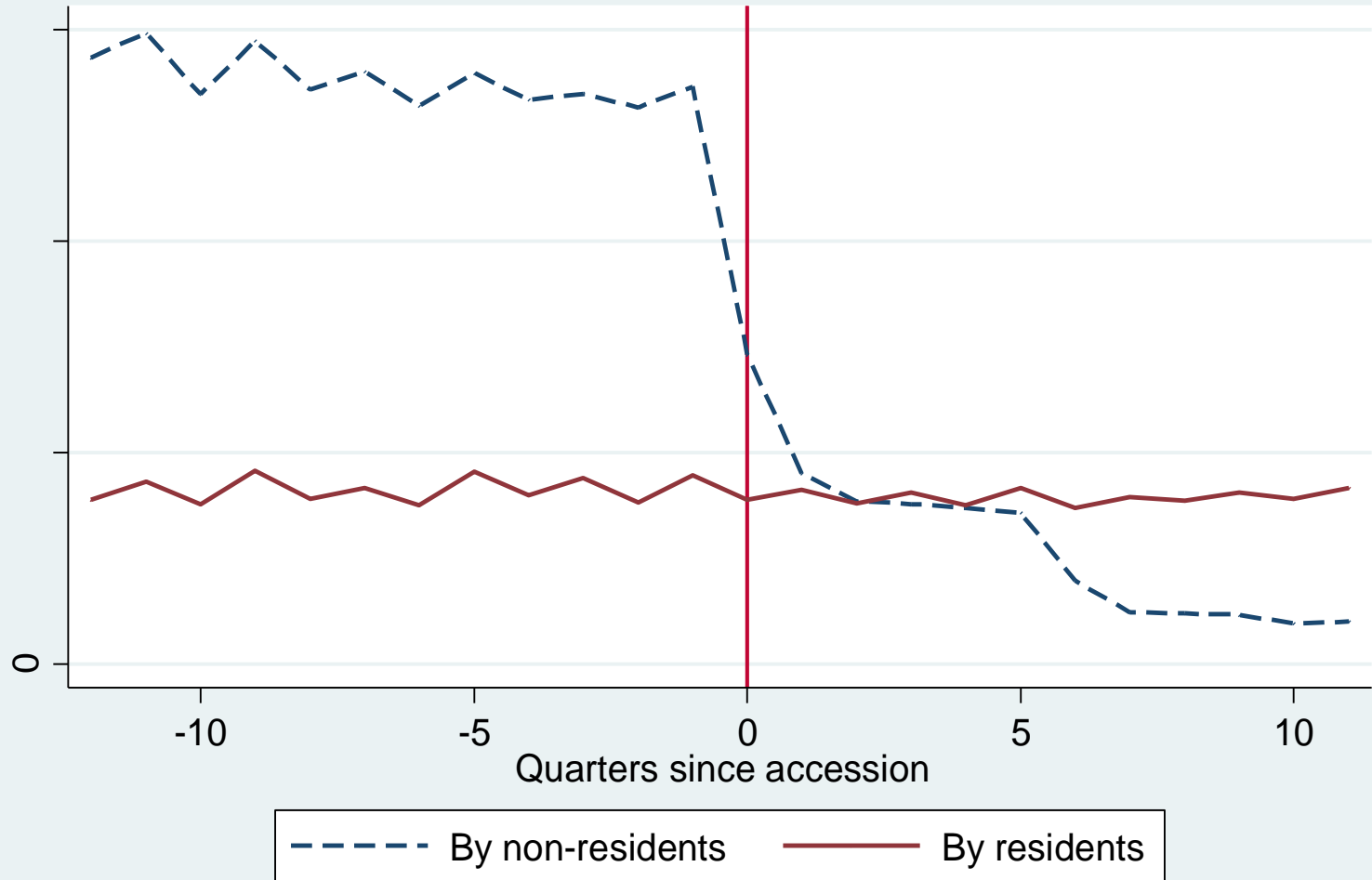Time period is 1995-2008

Effects of joining the EPC

Before accession			After accession		
National	EPO		National	EPO	
	Home	Abroad		Home	Abroad
Yes		Yes	Yes	No	Yes
No		Yes	No	Yes	Yes
			No	No	Yes
Yes		No	Yes	No	No
No		No	No	No	No

- Effect of accession comes from **change in costs** associated with obtaining a patent in a given country.
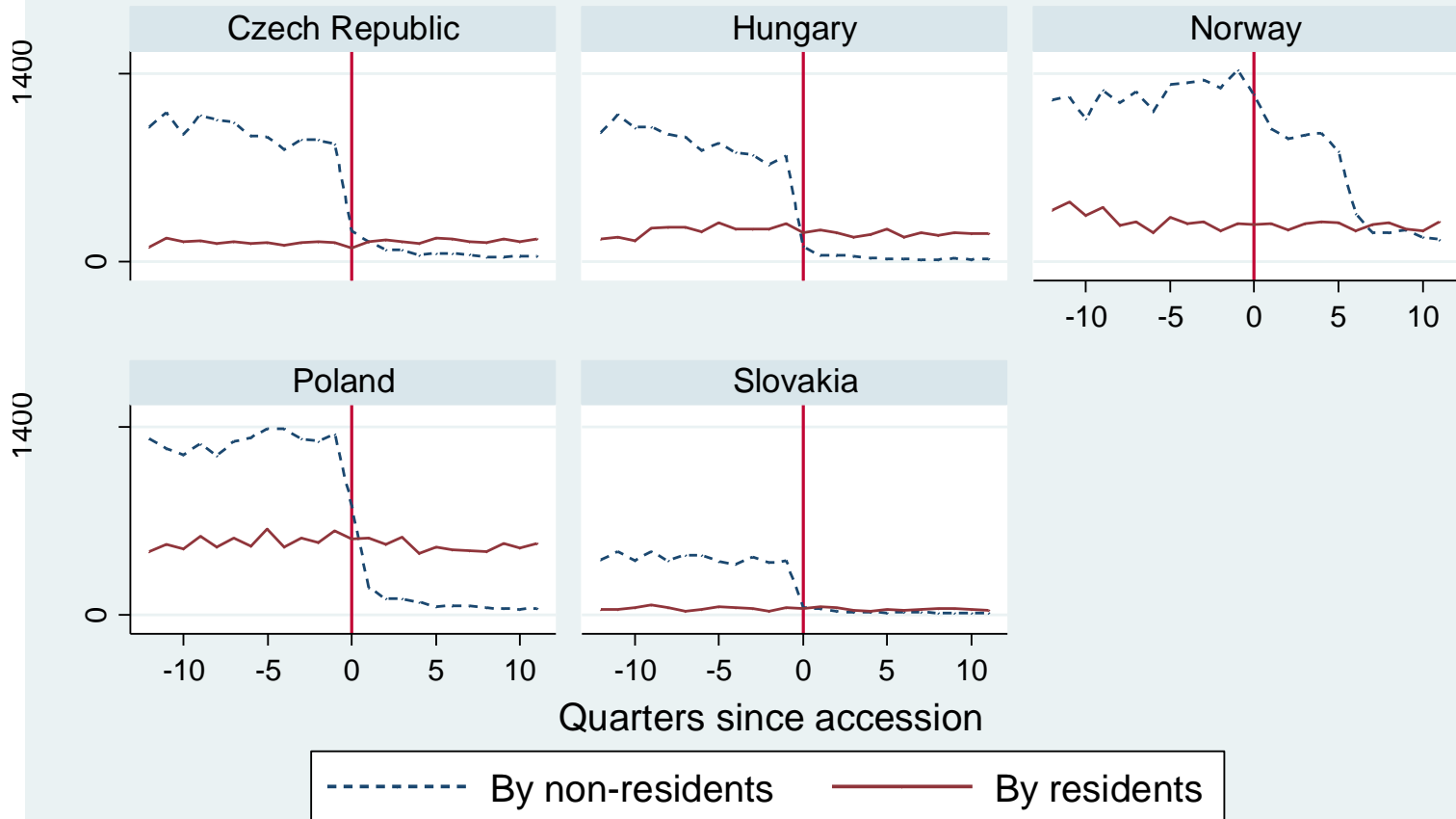
Data

- Patent data from Patstat (October 2015):
  - Applications filed at the EPO, national patent offices, and via the PCT route at WIPO
  - Designation and validation (fee payment) information
  - Filings by residents and non-residents
  - Inventor-level information
- Firm-level data from BvD Amadeus

1. Patent filings at national offices
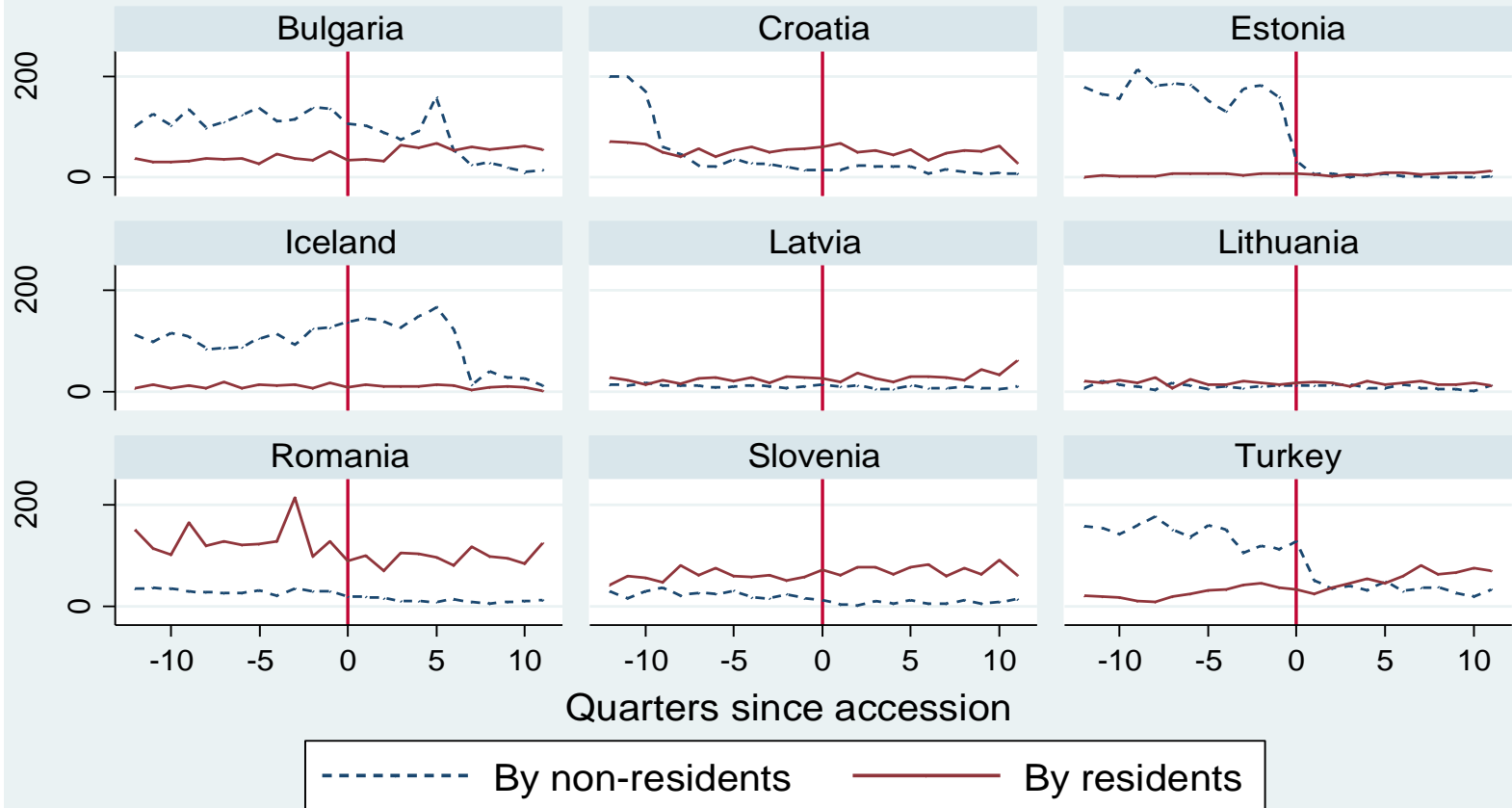## before and after accession

Quarters since accession

Legend: By non-residents — By residents

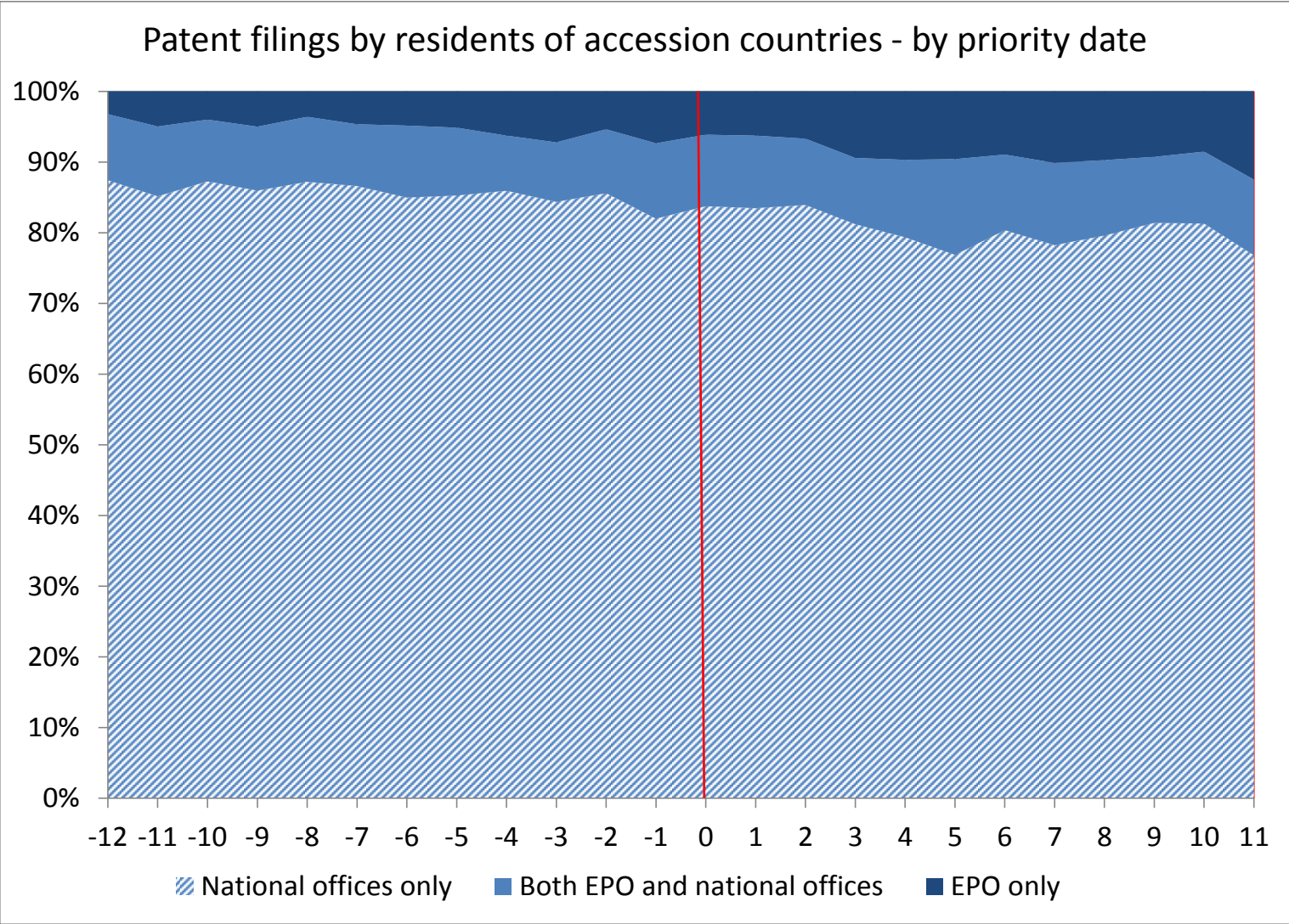# Patent filings at national offices
before and after accession

Graphs by Name of accession country

Patent filings at national offices
before and after accession

Graphs by Name of accession country

Patent filings by residents of accession countries - by priority date

Legend: National offices only / Both EPO and national offices / EPO only

(Non-)Resident patent filings

Predicting aggregate patent grants
Dependent variable: granted patents by filing quarter

	EPO grants to residents of accession countries	EPO grants to residents validated in accession countries	Resident grants at national offices	EPO grants to non-residents validated in accession countries	Non-resident grants at national offices
Post-accession dummy	0.29 (0.13)**	1.70 (0.41)***	-0.16 (0.05)**	1.10 (0.20)***	-1.06 (0.38)***
Post-accession trend	0.05 (0.02)***	-0.15 (0.16)	0.01 (0.01)	-0.27 (0.23)	-0.19 (0.06)***
N of observations	336	336	288	336	288
N of countries	14	14	12	14	12
Pseudo R-squared	0.713	0.713	0.916	0.898	0.908

All regressions include country and quarter-year dummies

Standard errors are robust and clustered on country.

Method of estimation is Poisson regression with robust standard errors

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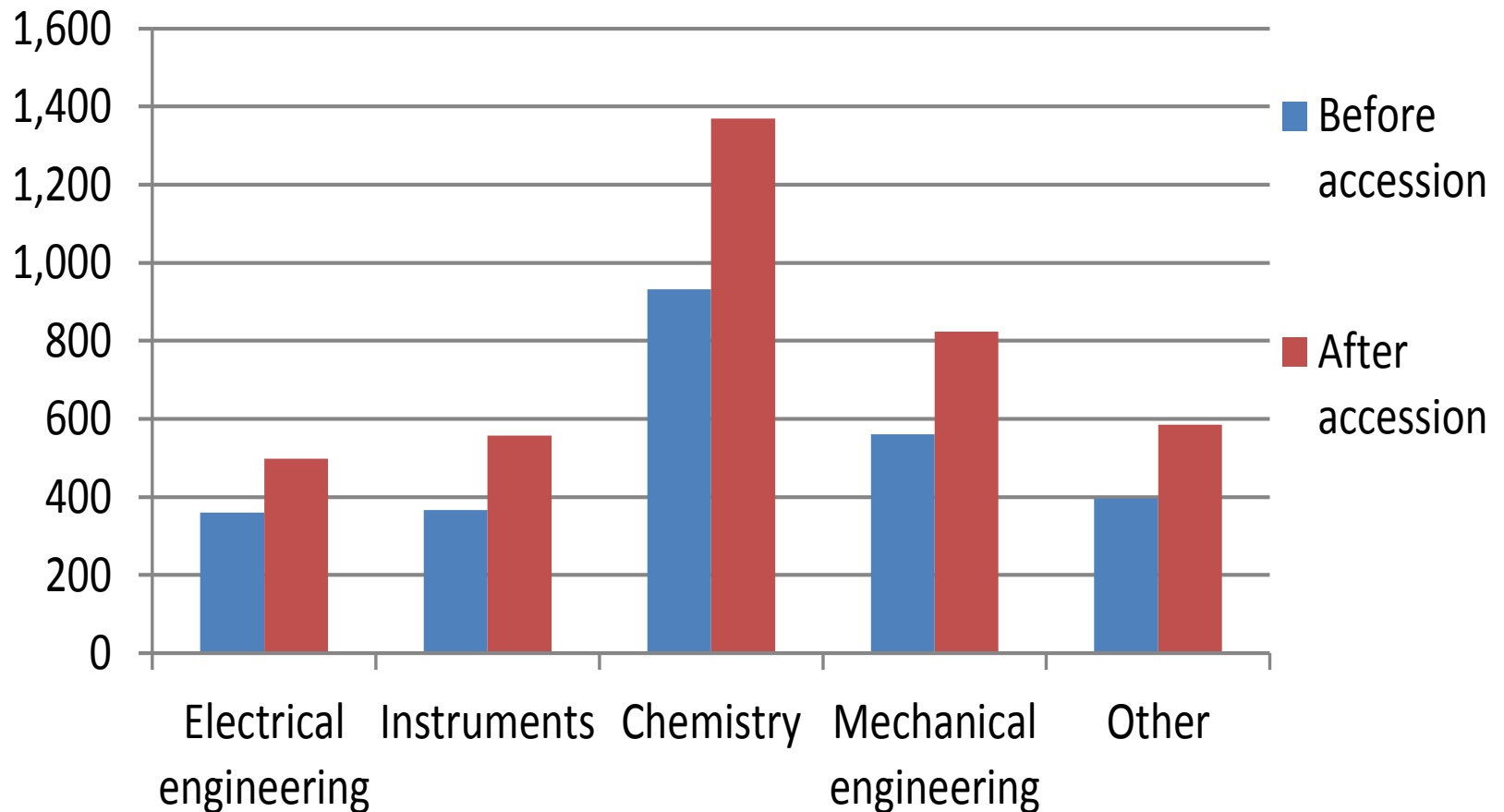All regressions include country and quarter-year dummies

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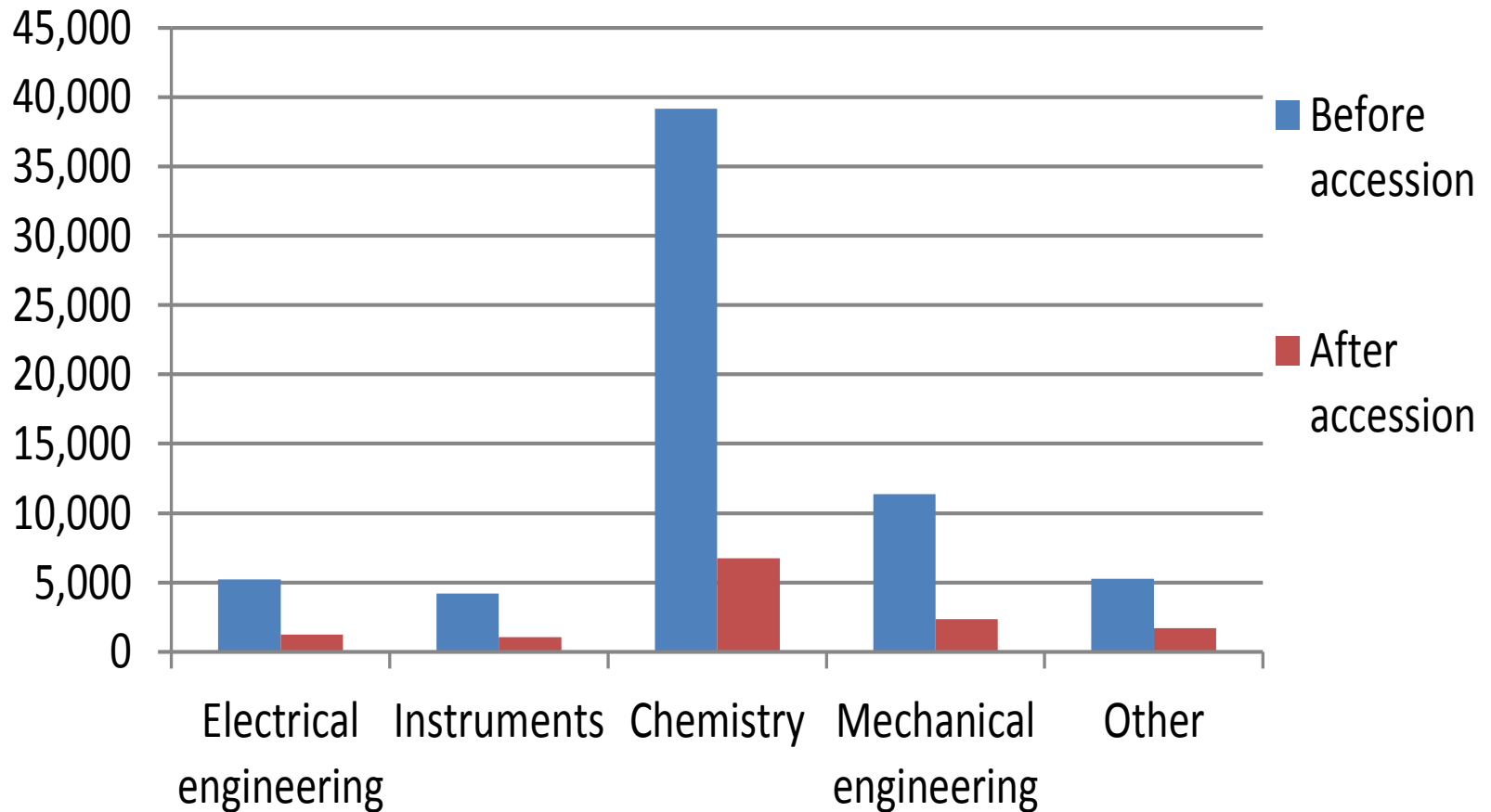
National office filings by residents of accession countries
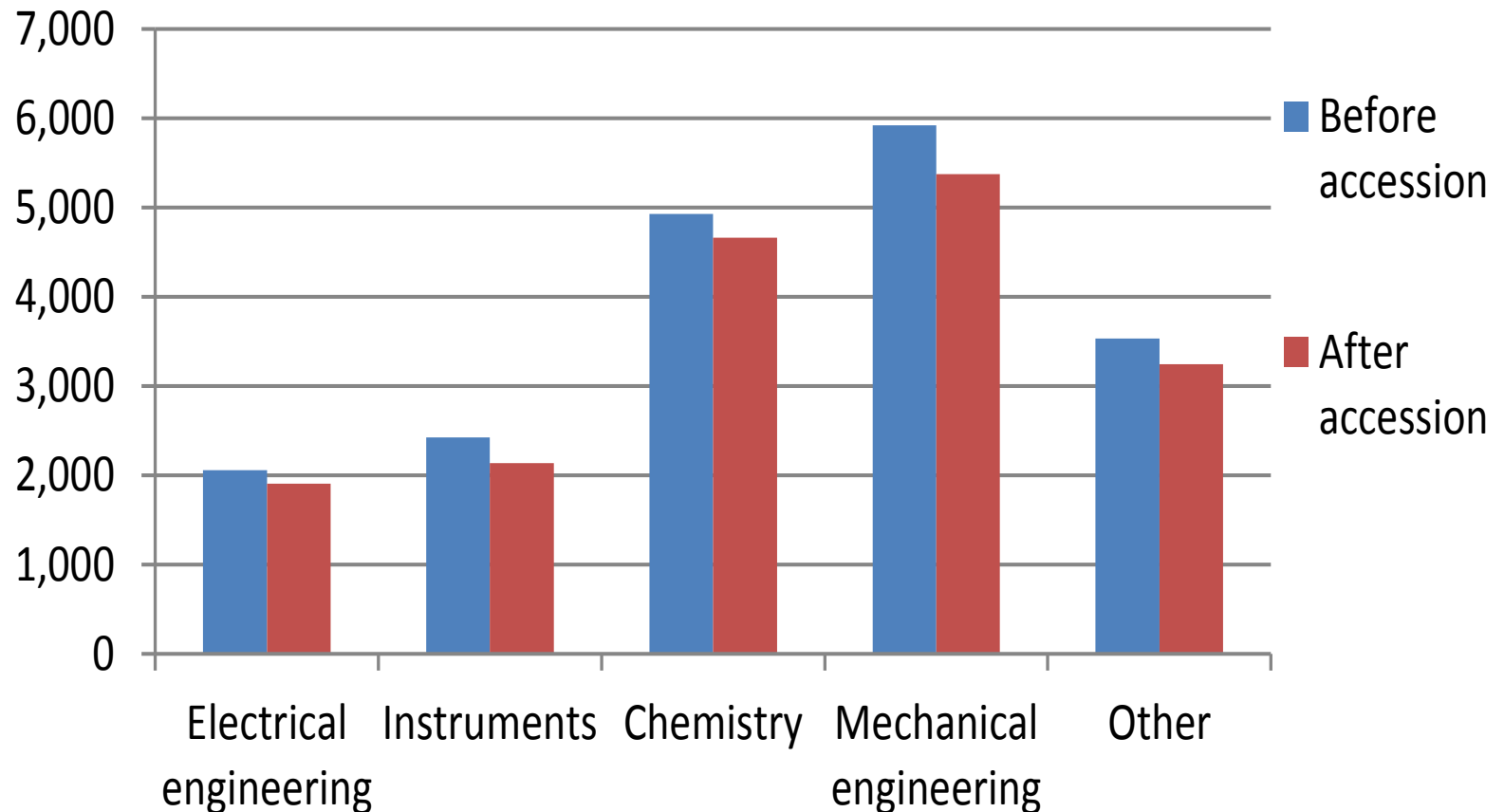
EPO filings by residents of accession countries

National office filings by non-residents of accession countries

Resident applicant-level filings

Predicting applicant-level patent applications

Dependent variable: National office patent applications by resident entity during the quarter (1995-2014)

	All	Firms	Individuals	Other#
Post-accession dummy	0.036*	-0.021	**-0.067****	-0.241*
	(0.025)	(0.054)	**(0.024)**	(0.104)
Post-accession trend	**0.022*****	0.010*	**0.014*****	**0.045*****
	(0.002)	(0.004)	**(0.002)**	**(0.012)**
D (entity patented before accession)	**0.337*****	0.106	-0.028	**0.472*****
	(0.032)	(0.067)	(0.032)	**(0.074)**
Log (past patenting rate)	**1.418*****	**1.322*****	**1.331*****	**1.180*****
	(0.016)	**(0.034)**	**(0.022)**	**(0.022)**
Observations	1,580,085	368,442	1,161,687	49,956
Entities	33,399	8,416	23,964	1,022
Share nonzero observations	102,389	29,450	62,747	10,192
Pseudo R-squared	0.320	0.296	0.222	0.497

Resident applicant-level filings

Dependent variable: EP patent applications by accession country resident entity during the quarter (1995-2014)

	All	Firms	Individuals	Other#
Post-accession dummy	0.891***	0.958***	0.674***	0.302
	(0.080)	(0.147)	(0.071)	(0.267)
Post-accession trend	0.041***	0.040***	0.018***	0.051*
	(0.006)	(0.009)	(0.004)	(0.023)
D (entity patented before	1.134***	1.247***	0.615***	1.942***
accession)	(0.043)	(0.065)	(0.147)	(0.147)
Log (past patenting rate)	1.367***	1.328***	1.311***	1.188***
	(0.015)	(0.014)	(0.042)	(0.042)
Observations	1,580,085	368,442	1,161,687	49,956
Entities	33,399	8,416	23,964	1,022
Share nonzero observations	21,161	8,795	11,091	1,275
Pseudo R-squared	0.362	0.440	0.278	0.319

All regressions include dummies for the accession countries and quarter-years.

Method of estimation is Poisson with robust standard errors clustered on patenting entity.

Past patenting rate is lagged patent stock at the relevant office divided by age in quarters

#Other includes government, universities, hospitals, and research institutes and academies.
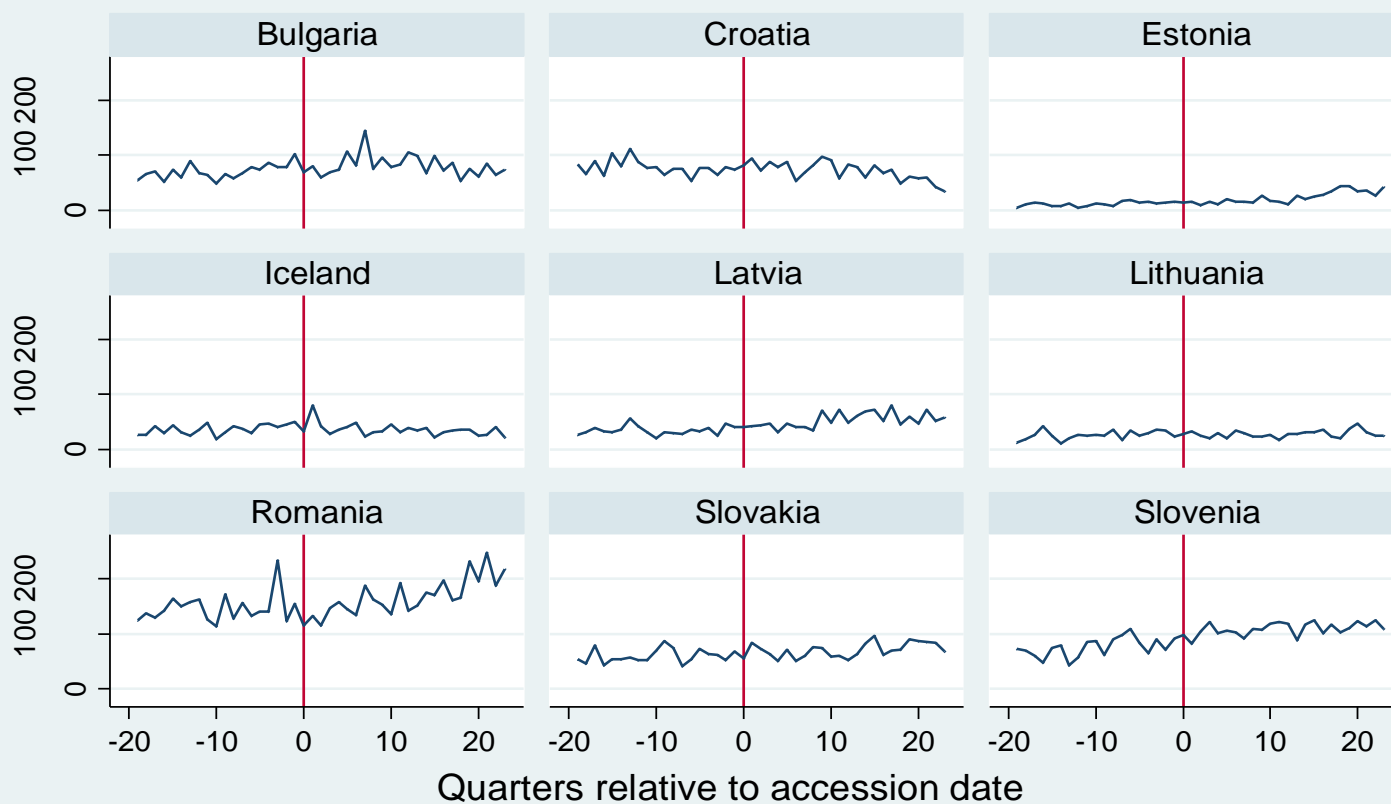
Resident inventor-level filings

Priority patent filings by accession country inventors before and after accession
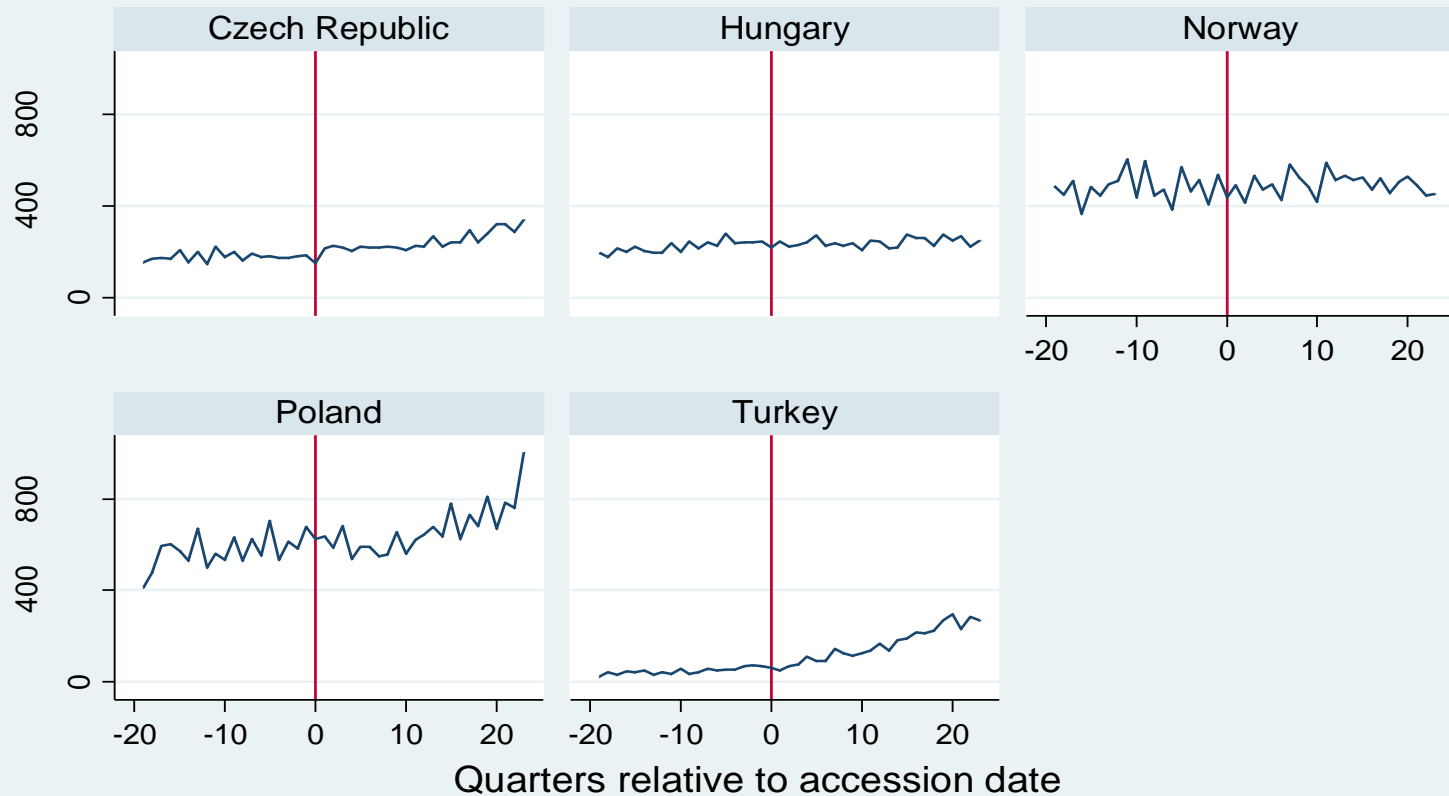
Graphs by Accession country

Resident inventor-level filings

Priority patent filings by accession country inventors before and after accession

Graphs by Accession country

Resident inventor-level filings

Predicting aggregate patent filings by accession country inventors

Dependent variable: log (patent filings by inventors resident in an accession country)

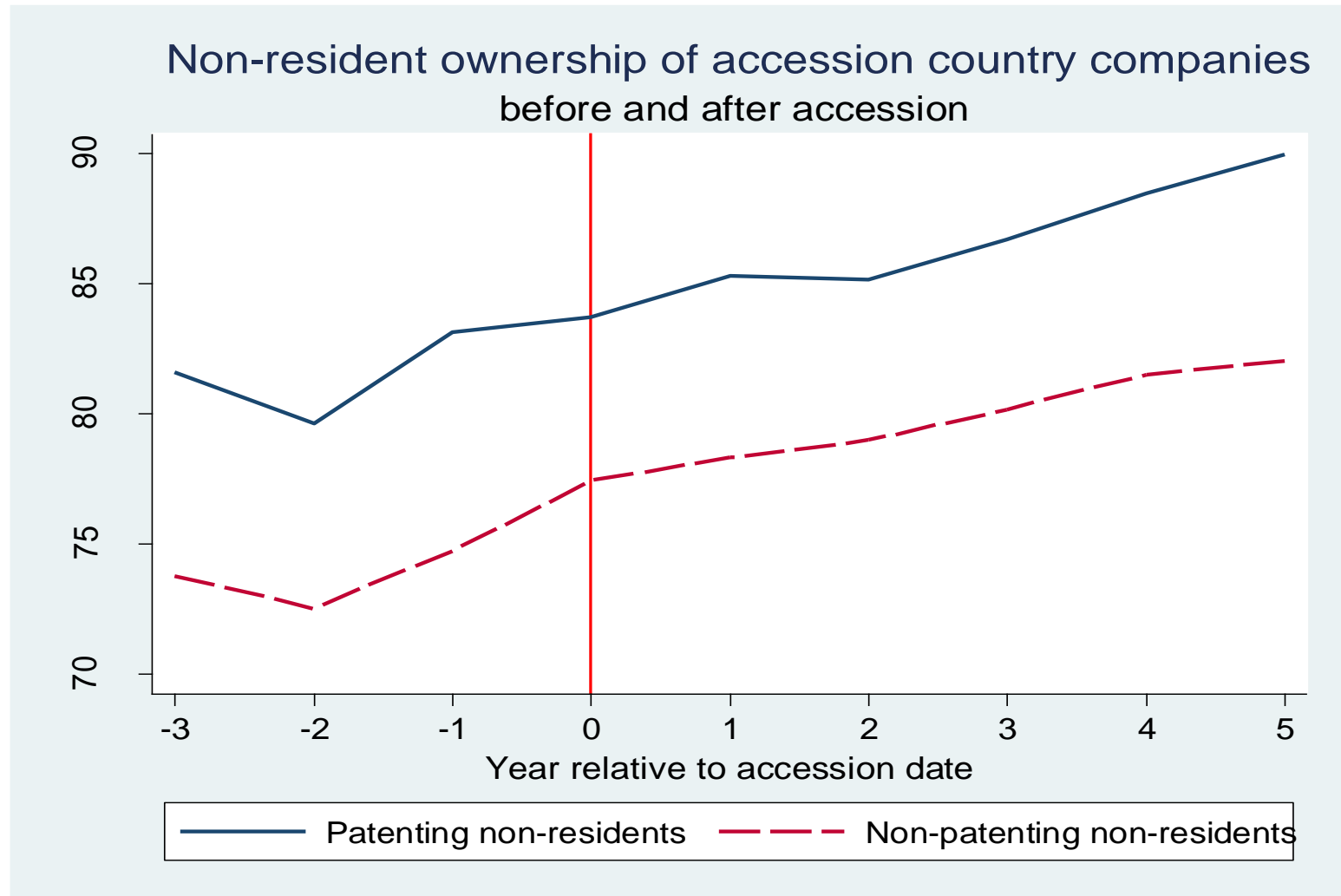1064 obs = 14 countries x 76 quarters (1995-2013)

	All, priority apps only	EPO applications	Applications at other offices	Applications at national offices
Total filings*	197,619	48,816	68,309	138,064
Pre-accession trend	-0.009 (0.006)	-0.004 (0.004)	-0.002 (0.003)	-0.019 (0.007)***
Post-accession dummy	-0.203 (0.090)**	0.025 (0.080)	0.085 (0.068)	-0.296 (0.121)**
Post-accession trend	0.026 (0.010)**	0.036 (0.010)***	0.028 (.006)***	0.029 (0.010)***
Country dummies	yes	yes	yes	yes
Quarter-year dummies	yes	yes	yes	yes
Pseudo R-squared	0.907	0.878	0.887	0.886

Standard errors are robust and clustered on country.

Poisson estimation

* Filings will not add up because the aggregate in the first column counts each priority only once.

Investment by non-residents

Non-resident ownership of accession country companies before and after accession

Legend: Patenting non-residents — Non-patenting non-residents

Investment by non-residents

Predicting firm-level non-resident ownership

Dependent variable: ownership share by non-resident company of resident company (2000-2011)

	All	*All*	*All*	*excl. NO & IS*	*excl. NO & IS*	*excl. NO & IS*
Post-accession dummy	-0.148	-0.187	-0.169	-0.151	-0.194	-0.182
	(0.184)	(0.183)	(0.184)	(0.288)	(0.288)	(0.288)
Post-accession trend	0.221**	0.218**	0.218**	-0.164	-0.163	-0.164
	(0.097)	(0.097)	(0.097)	(0.299)	(0.298)	(0.299)
D (validated EPO patent)		1.147**			0.927**	
		(0.045)			(0.468)	
Number of validated EPO patents			0.018**			0.016*
			(0.008)			(0.008)
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Observations	135,957	135,957	135,957	102,671	102,671	102,671
Entities	39,398	39,398	39,398	30,990	30,990	30,990
R-squared	0.004	0.004	0.006	0.013	0.014	0.013

Method of estimation is OLS with robust standard errors clustered at firm-accession country-level.

Conclusions

- Impact of introduction of an international patent system – especially on lower- and middle income economies:
  - Resident applicants hardly respond to accession;
  - Non-resident applicants respond strongly to accession.
- Policy:
  - Effect of joining the PCT
  - Effect of the European Unitary Patent