IP and performance: Empirical evidence from the UK

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Overview

- Overview of patenting & trademarking by UK firms with focus on small firms
- What do we know about the relationship between patenting and small firm performance?
- Innovation and survival of small firms
- Innovation and growth of small firms
- Innovation and inter-firm spillovers

The relation between small firms and IP

- SMEs may invest less in innovation because
  - Face higher risk & uncertainty (consequences more severe, e.g., bankruptcy)
  - Less able to diversify risk than large firm which spreads risk over many products/projects
  - Internal & external liquidity constraints
- SMEs may apply for less IP per innovation because
  - Lacking information about procedures
  - Cannot afford legal counsel
  - Cannot afford professional IP management
  - Fixed costs proportionately larger (cannot spread over range of projects)
  - Potential litigation costs extremely high

▷ Do we see too few innovative SMEs?

▷ Does the IP system help innovative SMEs?

Oxford Firm Level IP database (OFLIP)

- Main characteristics:
  - Covers population of UK firms over the period 2001-2005
  - Firm-specific characteristics and information on IP
  - Result of matching FAME database and firm-level IP datasets (Rogers et al., 2007)
- Components:
  - FAME
    2.04 mio active & 0.9 mio inactive firms
    $\triangleright$ Allows to identify **all** firms entering and exiting
  - UK IP Office: UK patents and trade marks
  - Marquesa Ltd.: Community trade marks
  - European Patent Office (EPO): EPO patents
  - ZEPHYR: M&A

Firm size

- Define firm sizes according to EU definitions
  - Large firms > £29 million assets (88,832 in 2005)
  - £29 million > SMEs > £2 million assets (159,399)
  - £2 million in assets < Micro (1,950,594)
- Subsidiaries of large UK firms are not classed as SMEs/micro firms
- Enormous differences in availability of data by size group - very little information available on SMEs and micro firms (total assets has largest coverage)

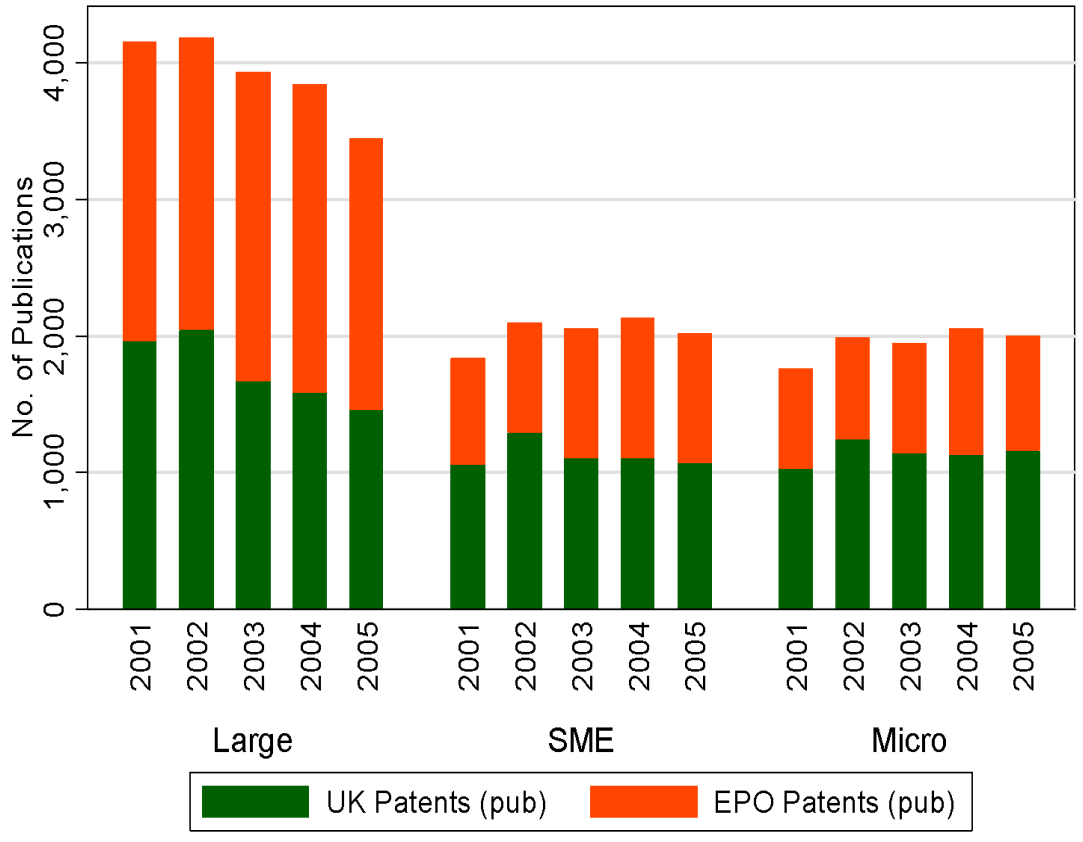
Some descriptive evidence

(Rogers, Helmers and Greenhalgh, 2007)

How many firms in UK use IP?

- Registered IP (UKP, EPO, UKTM, CTM)
- Over five year period 2001 to 2005
- 5.3% of large firms use some registered IP
- Figure much higher for largest few thousand
- 4.8% of SMEs
- 0.8% of micro firms

Number of UK and EPO patents by firm size category 2001-2005



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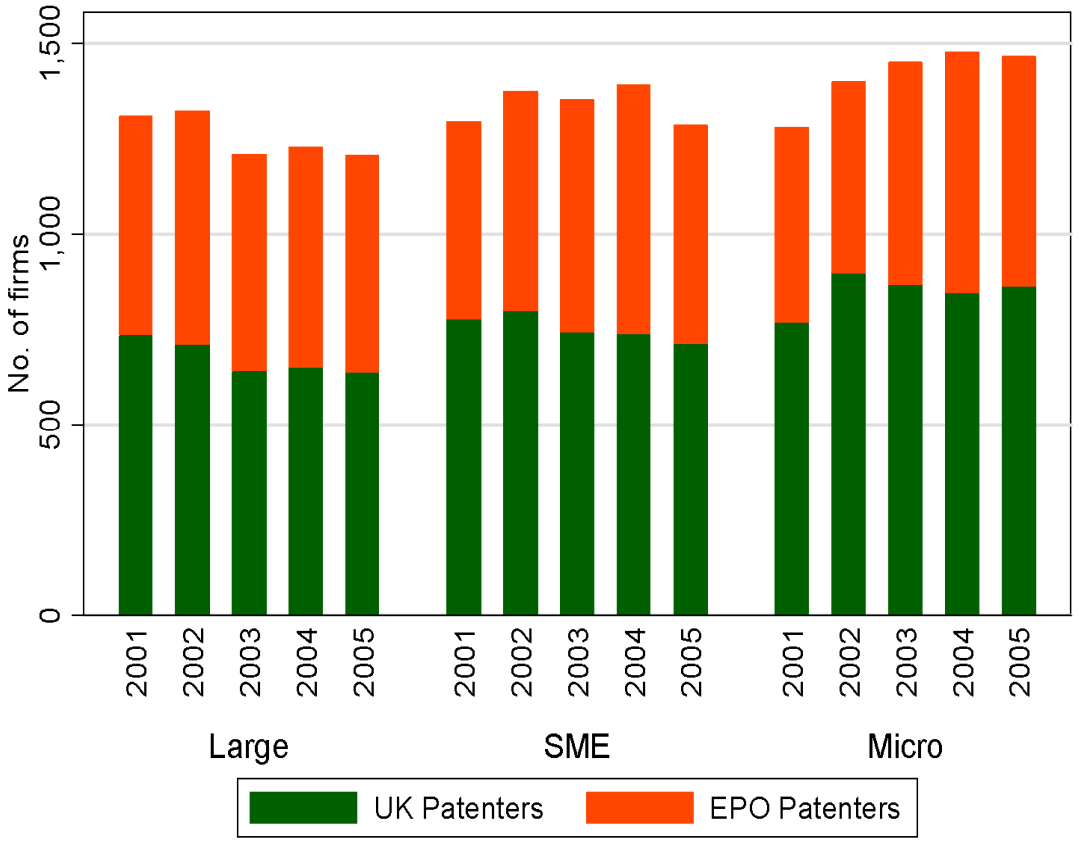

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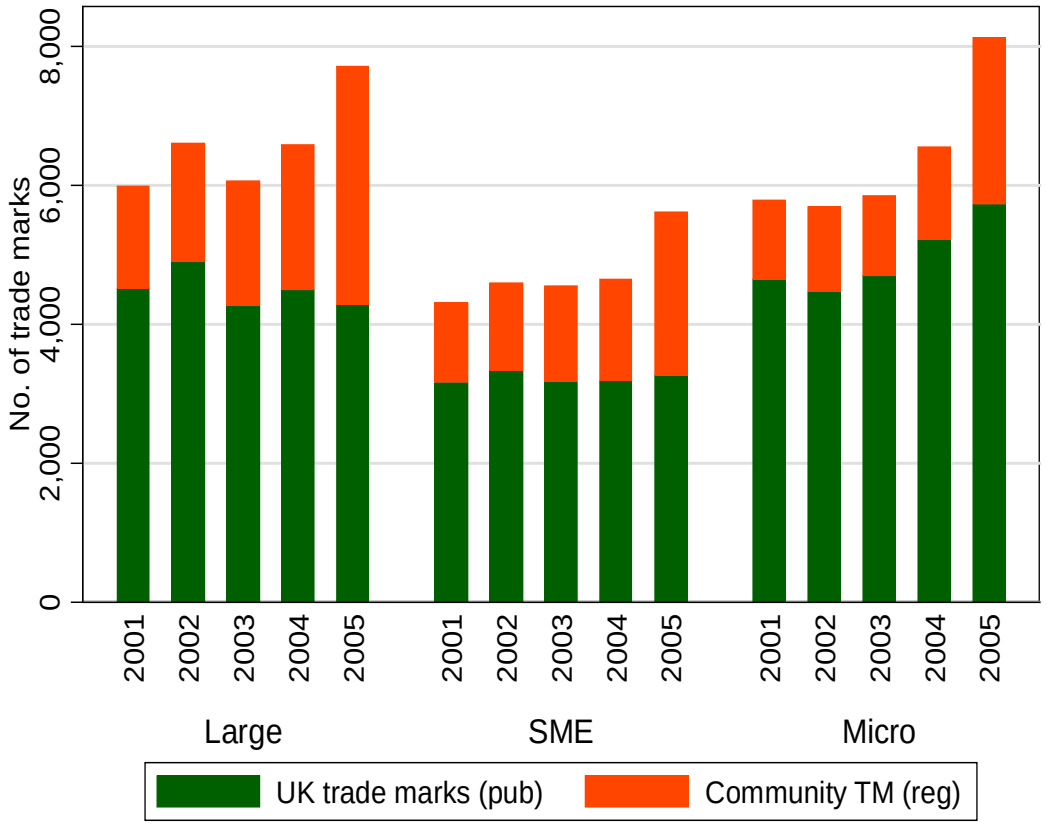

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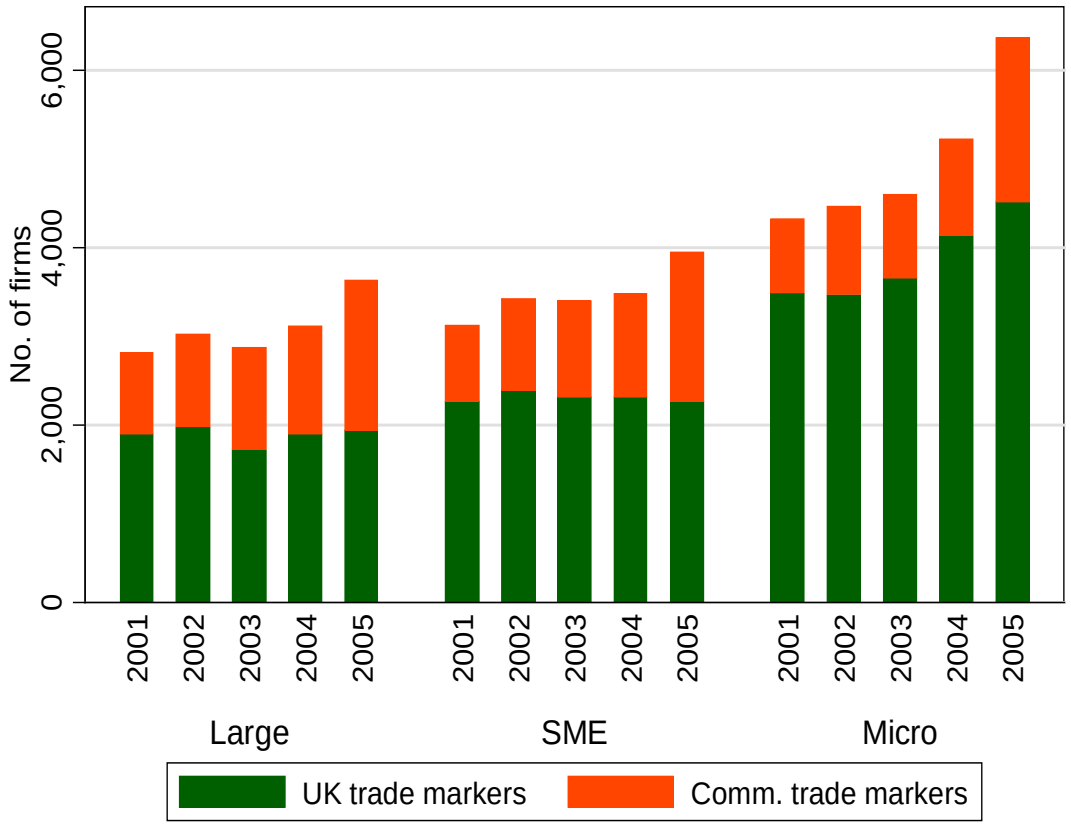
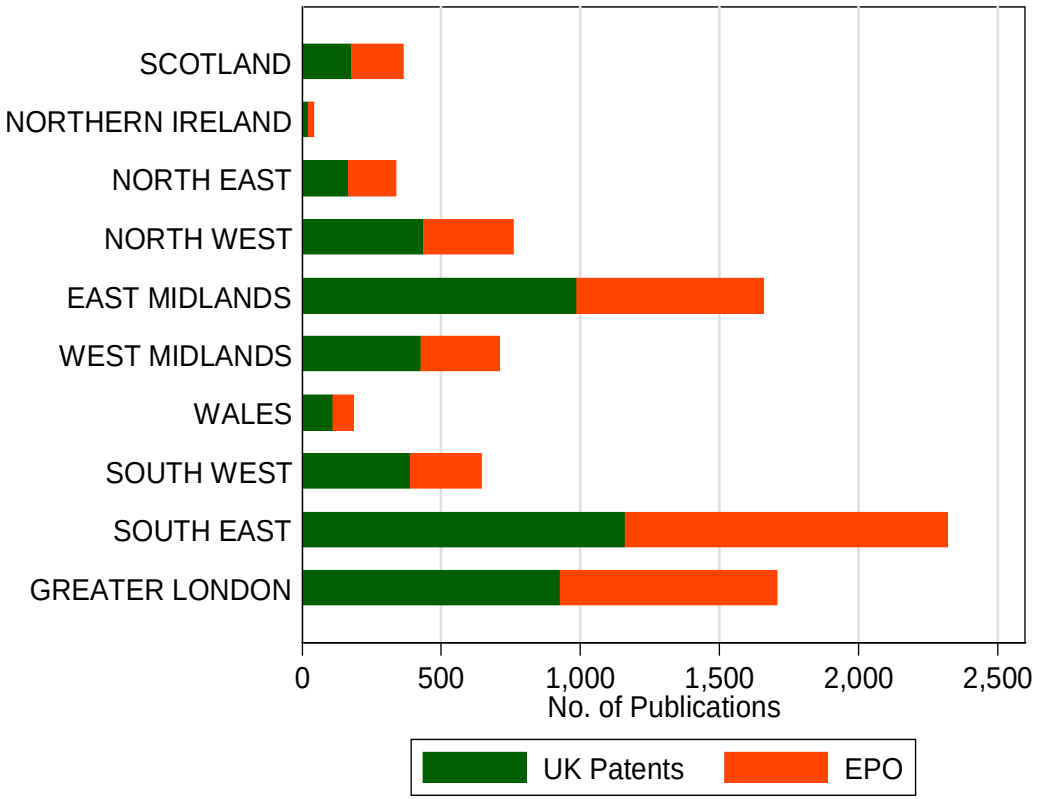


IP active SMEs and average publications (by sector, 2001-2005)

Sector	UK TM	Av	Com. TM	Av	UK Pat	Av	EPO Pat	Av
Agric. Mining	420	1.6	148	1.7	35	2.1	38	2.1
Manufacturing	2,226	1.7	1,307	1.6	1,734	1.6	1,202	1.7
EGW, construction	204	1.4	33	1.5	94	1.4	33	1.3
Whole, retail, hotel	2,507	1.8	1,004	1.8	243	1.7	131	1.4
Transport, telecom.	292	1.7	154	1.6	43	5.0	26	2.3
Finance, real estate	445	1.5	150	1.3	21	1.2	15	1.2
Computer related	576	1.6	596	1.6	185	2.0	158	1.8
R&D services	128	2.4	127	1.5	227	3.4	372	2.6
Business Services	1,383	1.6	699	1.6	321	1.9	262	2.3
Health, educ, culture	1,073	1.6	428	1.5	99	1.4	116	1.7
Missing in FAME	191	1.7	136	1.5	99	1.3	70	1.8
All sectors	9,445	1.7	4,782	1.6	3,101	1.8	2,423	1.9

Note: Columns show the number of IP active firms in each sector and also the average number of publications (or registrations for CTMs) for each firm.

Number of patents published by region (SMEs only, 2001-2005)



Number of trade marks by region (SMEs only, 2001-2005)

Outcome of 2001 SME cohort in 2004

Outcome in 2004	IP inactive in 2001		IP active in 2001		All firms	
	No.	%	No.	%	No.	%
Large	8,115	6.39	240	7.69	8,355	6.42
SME	98,974	77.96	2,460	78.85	101,434	78.0
Micro	13,200	10.40	265	8.49	13,465	10.35
Exited	6,673	5.26	155	4.97	6,828	5.25
Total	126,962	100	3,120	100	130,082	100

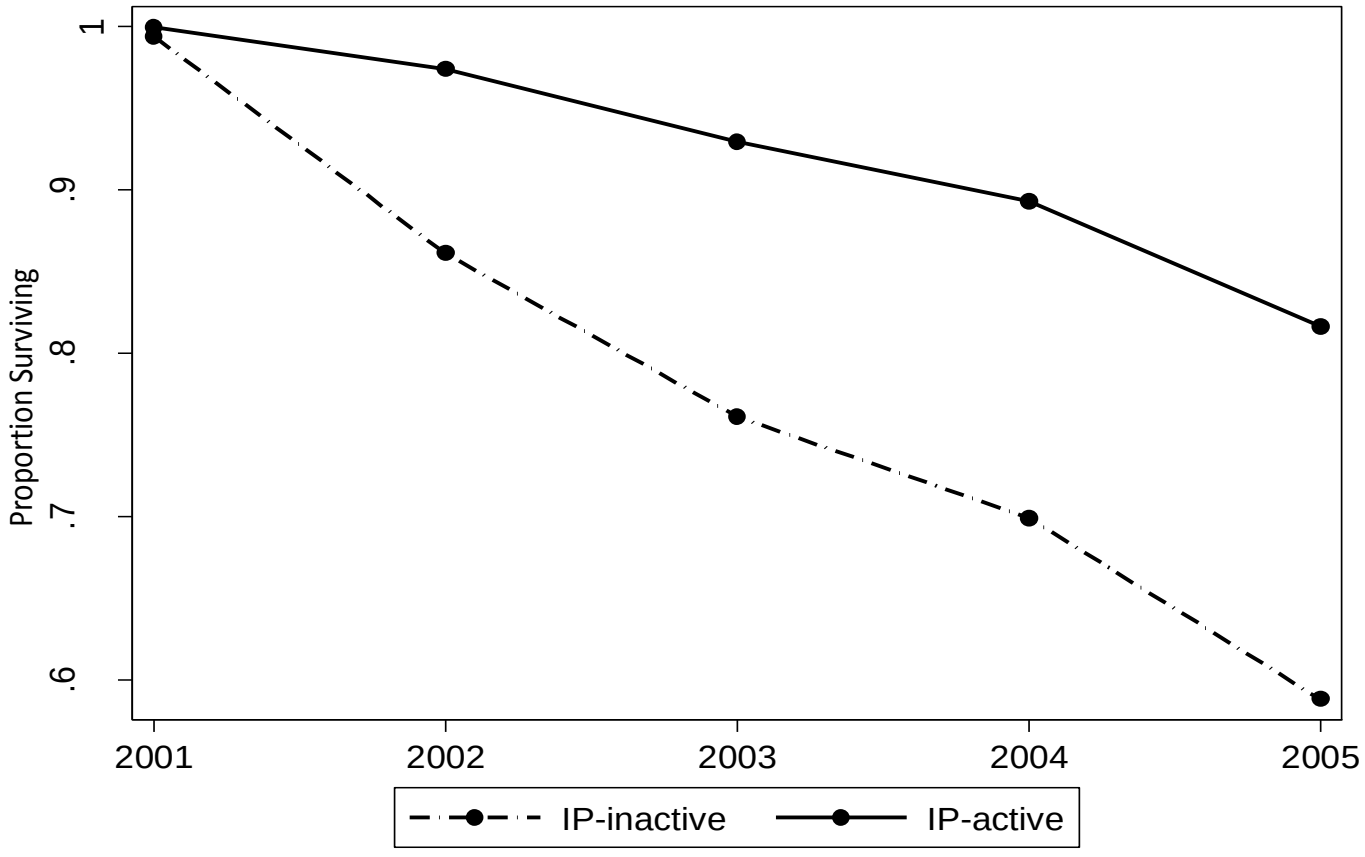
Note: χ^2 test of differences between IP active and inactive significant at 1%.

Innovation and firm survival
(Helmers and Rogers, 2008)

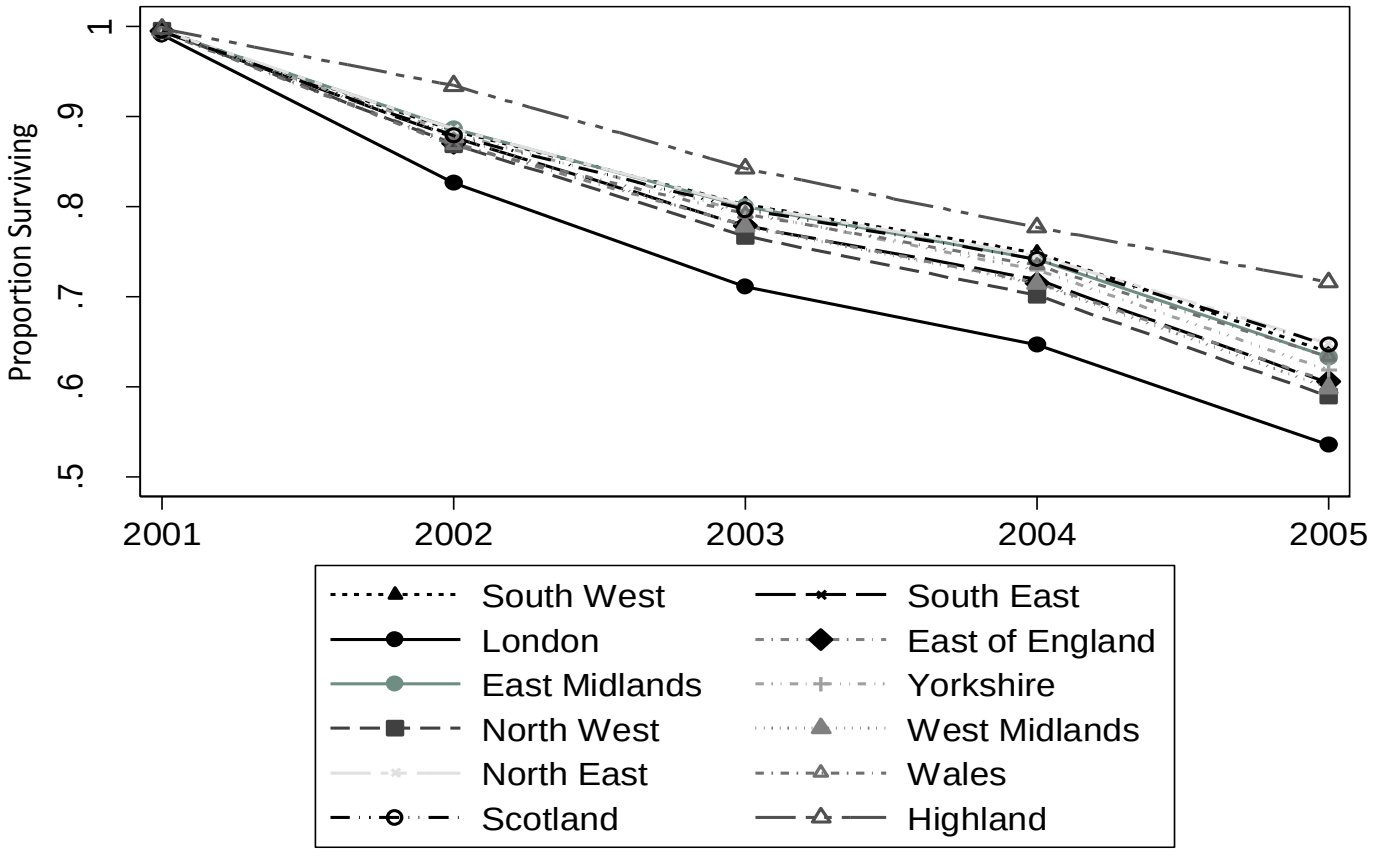
Innovation and firm survival

- Large part of new firms fails:
  - Disney et al. (2003) for UK: Around 35% of new firms survive after five years
  - In our data around 30% of new firms survive five years
- Assume that failure is caused by
  1. Underlying quality of the firm's idea relative to others in the market
  2. Resources available to the entrepreneur to capitalize on the idea
- IP as proxy for quality of idea, as well as resources (management and human capital)
- Does IP affect the most fundamental measure of firm performance - survival?

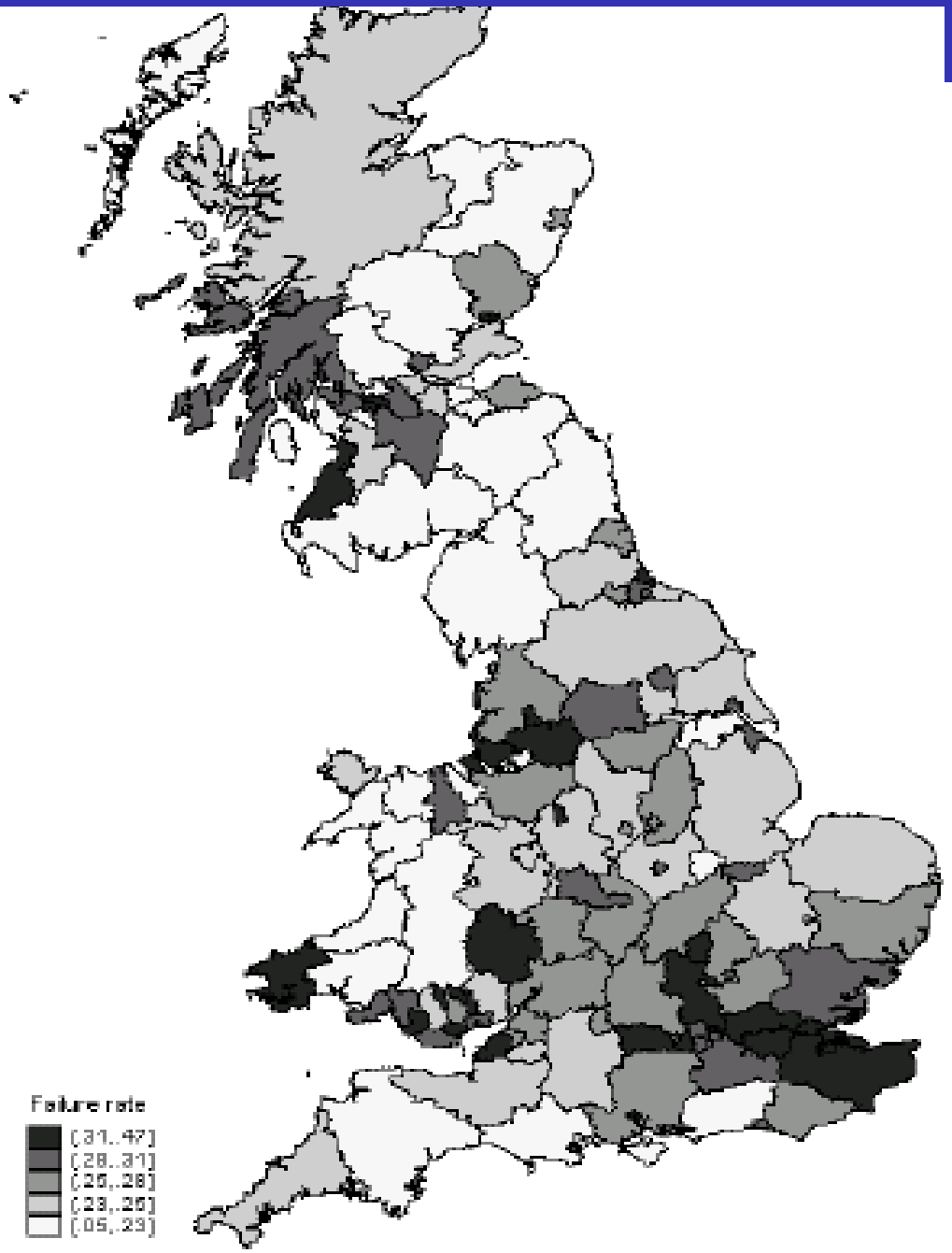
Survival rates for IP-active and IP-inactive firms



Survival rates across British regions



Failure rates of IP-inactive firms by county / unitary authority



Summary: Innovation and firm survival

- IP matters
  - 3,750 (2.3 %) of 2001 start-up firms IP-active - most common form of IP is UK trade mark
  - IP-active firms experience lower hazard rate of failure
  - Being a patentee reduces chances of exit (by 55% relative to non-patentee)
  - Addition of one UK patent reduces exit (40%)
  - Addition of one EPO patent reduces exit (41%)
- Geography matters
  - Large differences across regions
  - Not explained by range of industry and firm-level variables
- Identification issue: patentees may be better managed with better ideas?

Innovation and firm growth

(Helmers, 2008; Helmers and Rogers, 2009)

Innovation and firm growth

- Fundamental role of patents:
  - Allow innovators to profit from their inventions
  - Encourage entry of new firms based on inventions
- If true: Patenting firms and patenting start-ups in particular should be more successful than their non-patenting counterparts
- Very few studies about patent effect on firm growth
- Do patents improve performance measured as growth of start-up firms compared to start-ups that do not patent?

Challenges

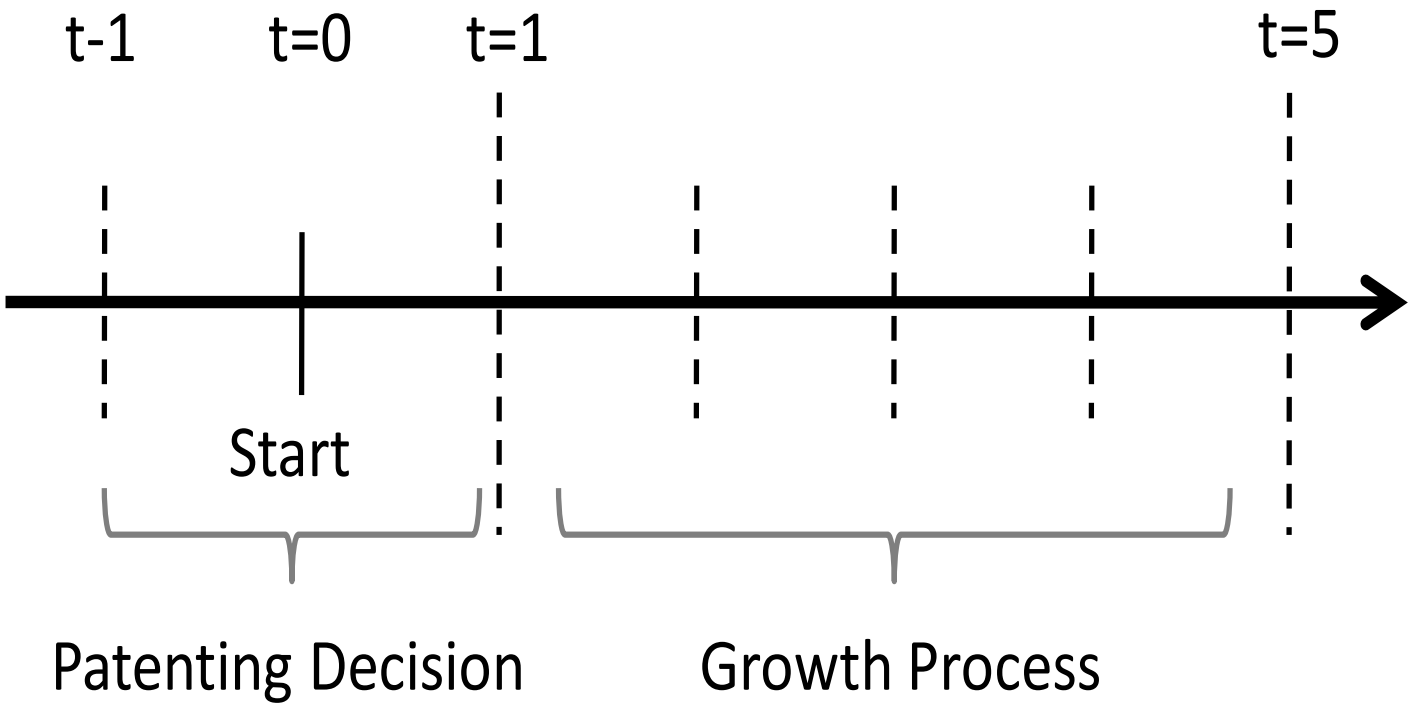
- Difficult to single out patent effect from confounding factors:
  1. Data availability on patenting of start-up firms
  2. Financial data on performance measure - before & after the patent filed, published or granted
  3. Absence of the counterfactual - need a control group of non-patentees
  4. Role of unobservables - spillovers
- Link between patent value distribution and new firm performance distribution
  $\Rightarrow$ Association of a firm's performance and patenting activity may vary across the distribution of growth rates
  1. Need to track all outcomes
  2. Looking only at averages not sufficient to unveil patent effect
- Use data on high- and medium-tech start-ups in UK (2000-2005)

Identification Strategy

- No data from a randomized experiment - firms choose whether to patent!

1. Firm heterogeneity: Restrict our sample to a cohort of high- and medium-tech firms incorporated in 2000
   $\Rightarrow$ Assume firm incorporated to capitalize on a patentable invention made before date of incorporation
2. Simultaneity between a firm's decision to patent and its performance: Decision to patent made *before* a firm starts competing in the market & 'selection on observables'
   $\Rightarrow$ Assume that a firm's observed decision to patent conditional on determinants exogenous w.r.t. performance
3. Selection bias due to firm exit: Condition on firm's propensity to survive $\Rightarrow$ Model exit
4. Unobserved localized spillovers: Incorporate measure of spillovers based on geographical proximity

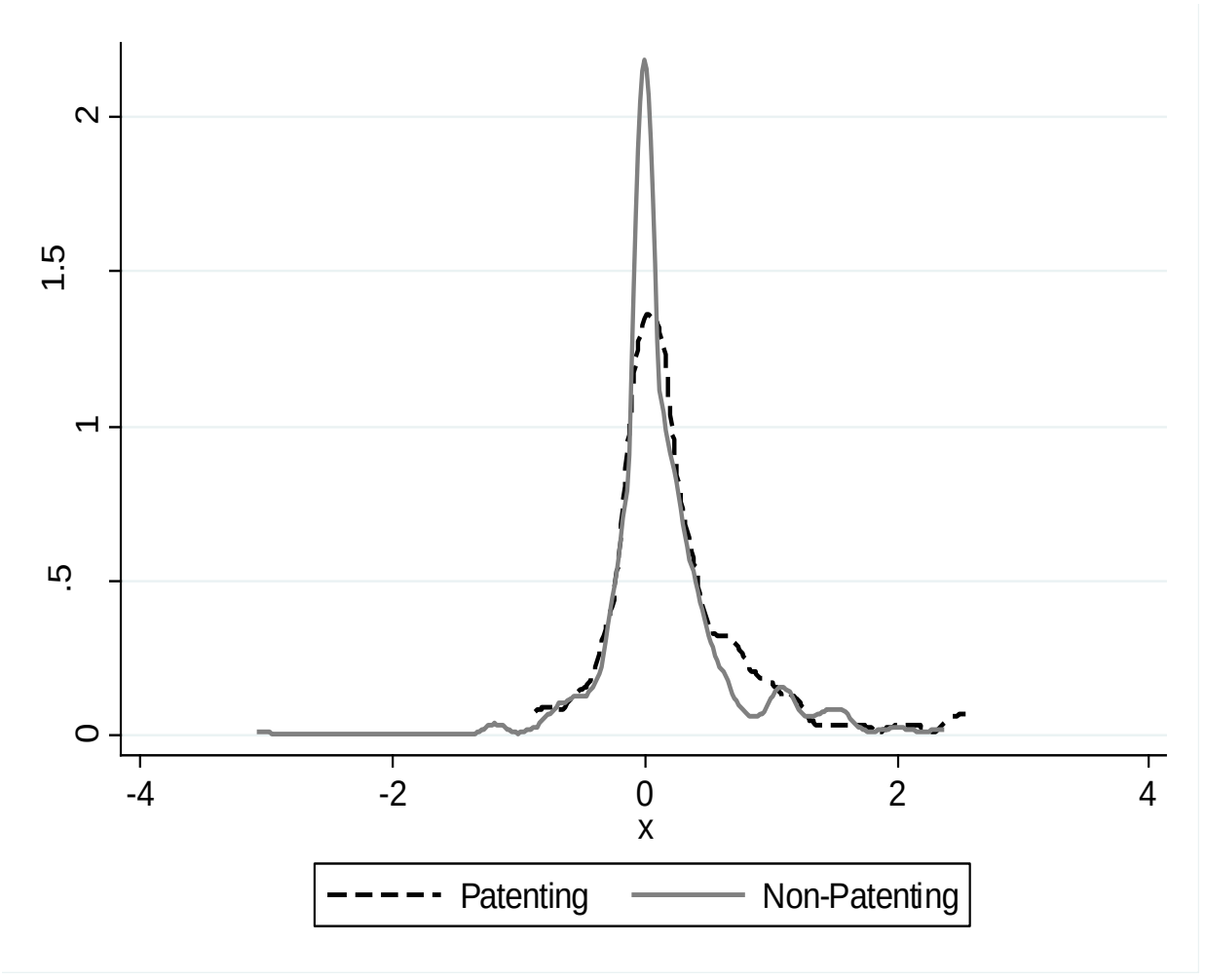
Identification Strategy - Time Line



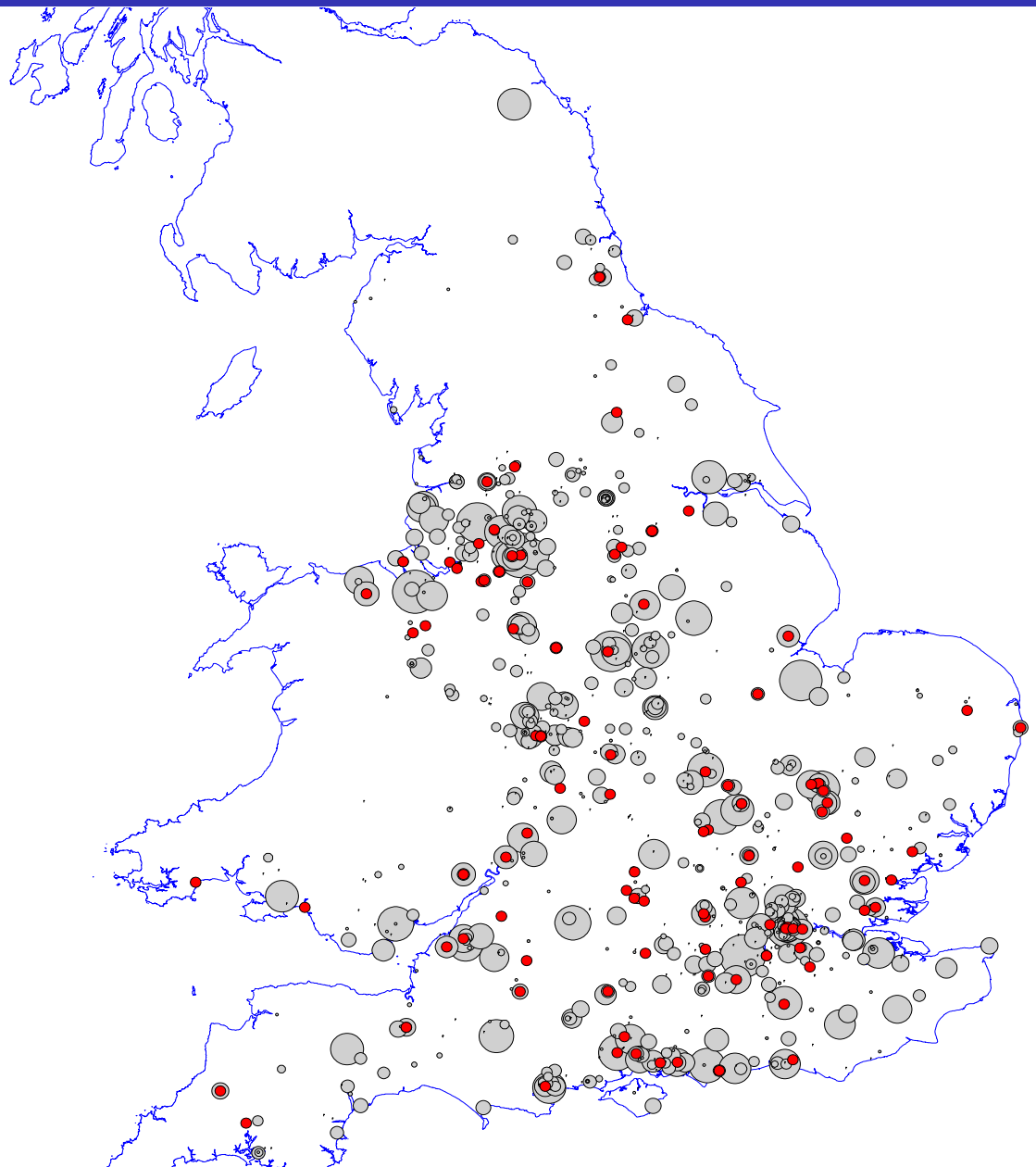
Sector Overview

Description	SIC-3
Manufacture of Chemicals and Chemical Products	24
Manufacture of Machinery and Equipment	29
Manufacture of Office Machinery and Computers	300
Manufacture of Electrical Machinery and Apparatus	31
Manufacture of Radio, Television and Communication Equipment	32
Manufacture of Medical, Precision and Optical Instruments	33
Manufacture of Motor Vehicles, Trailers and Semi-Trailers	34
Manufacture of Railway and Tramway Locomotives	352
Manufacture of Aircraft and Spacecraft	353

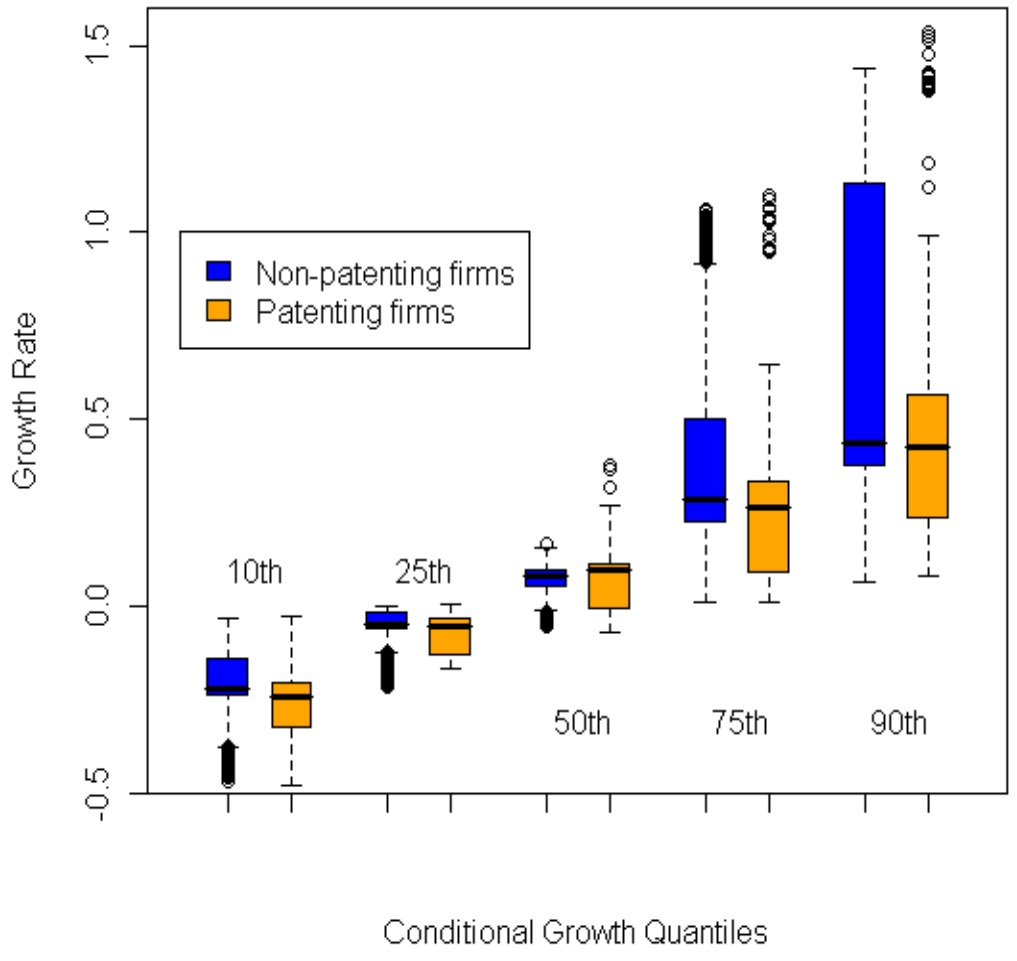
Density Distributions of Patenting vs. Non-Patenting Firms



Map of Firms' Location



Nonparametric Quantile Regression Plot: Patenting vs Non-patenting Firms



Summary: Innovation and firm growth

- High-growth firms cluster
- Patenting firms are better at locating next to high-growth firms within a distance band of approximately 40 miles

$\Rightarrow$ Closeness to high-growth firms associated with considerable positive effect on own growth performance.

- Statistically significant effect of patenting on firm growth result of arbitrary linear parametric specification
- Using flexible functional form - no statistically significant effect of patents on firm growth

$\Rightarrow$ Patents do not have any statistically robust effect on firm growth.

Findings

- Descriptive evidence:

  Evidence refutes view that small firms innovate less (proportionately) than larger firms

  Some evidence that SMEs gain from IP

- Innovation and firm survival:

  Evidence that survival positively correlated with IP

- Innovation and firm growth

  Little *robust* evidence for correlation between growth and IP

- Innovation and spillover

  Some evidence for importance for IP active firms of inter-firm spillovers

References

- Helmers, C. (2008): 'Patents, Spillovers and Firm Performance - Evidence from UK Start-Ups', mimeo Oxford University Department of Economics.
- Helmers, C., and Rogers M. (2008): 'Innovation and the Survival of New Firms Across British Regions', Oxford University Department of Economics Working Paper No. 419.
- Helmers, C., and Rogers M. (2009): 'Does Patenting Help High-Tech Start-Ups?', IPRIA Working Paper.
- Disney, R., Haskel, J. and Heden, Y. (2003): 'Entry, exit and establishment survival in UK manufacturing', *Journal of Industrial Economics*, 51(1), pp. 91-112.
- Rogers M., Helmers C. and Greenhalgh C. (2007): 'An analysis of the characteristics of small and medium enterprises that use intellectual property', Oxford Intellectual Property Research Centre.