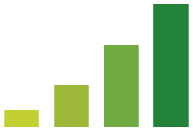

Institute for Fiscal Studies

Corporate taxes and the location of intellectual property

Helen Miller

Bruegel, September 2011

Motivation

- Governments around the world are grappling with the question of how to tax the income from intellectual property
  - important component of firms' activity and economic growth
  - income is highly mobile - firms can and do locate income offshore to reduce tax liability

The OECD describes how one of the most important commercial developments in recent decades is the fact that intangible property is used simultaneously by many different parts of a firm; and that it is easy for firms to move intangible property around the globe

A tax lawyer quoted in the New York Times said: "…most of the assets that are going to be reallocated as part of a global repositioning are intellectual property…that is where most of the profit is."

Motivation

- Governments around the world are grappling with the question of how to tax the income from intellectual property
  - important component of firms' activity and economic growth
  - income is highly mobile - firms can and do locate income offshore to reduce tax liability
  - tax can also distort the location and organisation of real activities

- Policy moves
  - modifications to CFC rules in US and UK
  - number of European countries recently introduced 'Patent Boxes'

Plan

1. Patent Boxes – what are they are why have countries introduced them?

2. *Corporate taxes and the location of intellectual property– Griffith, Miller and O'Connell (2011)*
   - empirical evidence on how responsive the location of IP is to corporate tax
   - *Simulating the effects of Patent Boxes*

3. *Government tax setting – work going forward*
   - model a process of strategic government tax setting

Policy: Patent Boxes

- Substantially reduced rate of corporation tax for the income derived from patents
- Recently introduced by a number of European countries
  - Belgium 6.8% (full rate, 34%); Netherlands 10% (full rate, 25%); Luxembourg 5.9% (full rate, 39%)
  - Some other countries operate similar policies (France, Spain)
  - UK to introduce in 2013, 10% (full rate, 24%)
- Operate differently across countries

Patent Box as an innovation policy

- Stated aim of the UK policy:
  - *"strengthen the incentives to invest in innovative industries and ensure the UK remains an attractive location for innovation"*
- Poorly targeted - targets **income** from ideas, not the activity that generates new ideas
  - No market failures at this stage (patents give monopoly rights)
  - external benefits to failed as well as successful research
  - income is a function of both the quality of the idea & firms' market power
  - large time lag between a new idea and the income stream from patents

Patent Box as an innovation policy

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- Poorly targeted - targets **income** from ideas, not the activity that generates new ideas
- Research can be located separately from income
  - Some benefits of Patent Box rely on co-location of research
  - Depends on costs of relocating income

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- Research can be located separately from income
- Implementation difficult – e.g. defining "income from a patent"
  - UK design decisions will weaken link to innovation

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- Implementation difficult – e.g. defining "income from a patent"
- Significant revenue cost
  - UK Government estimates £1.1bn a year

Patent Box as an innovation policy

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- Poorly targeted - targets **income** from ideas, not the activity that generates new ideas
- Research can be located separately from income
- Implementation difficult – e.g. defining "income from a patent"
- Significant revenue cost
- Large deadweight cost
- Benefits accrue to a small number of firms
- Distorts the decision to invest in patentable technologies

Patent Box as a preferential rate for mobile income

- *ensure the UK remains an attractive location for innovation*
- Preferential rate on an important form of more mobile activities
- Mirrlees review: *"In principle, it would be efficient to tax rents from relatively immobile activities at a higher rate than rents from more mobile activities"*
- In practice
  - mobile income subject to lower effective rates
  - but explicit differentiation difficult to implement and discouraged by international agreements

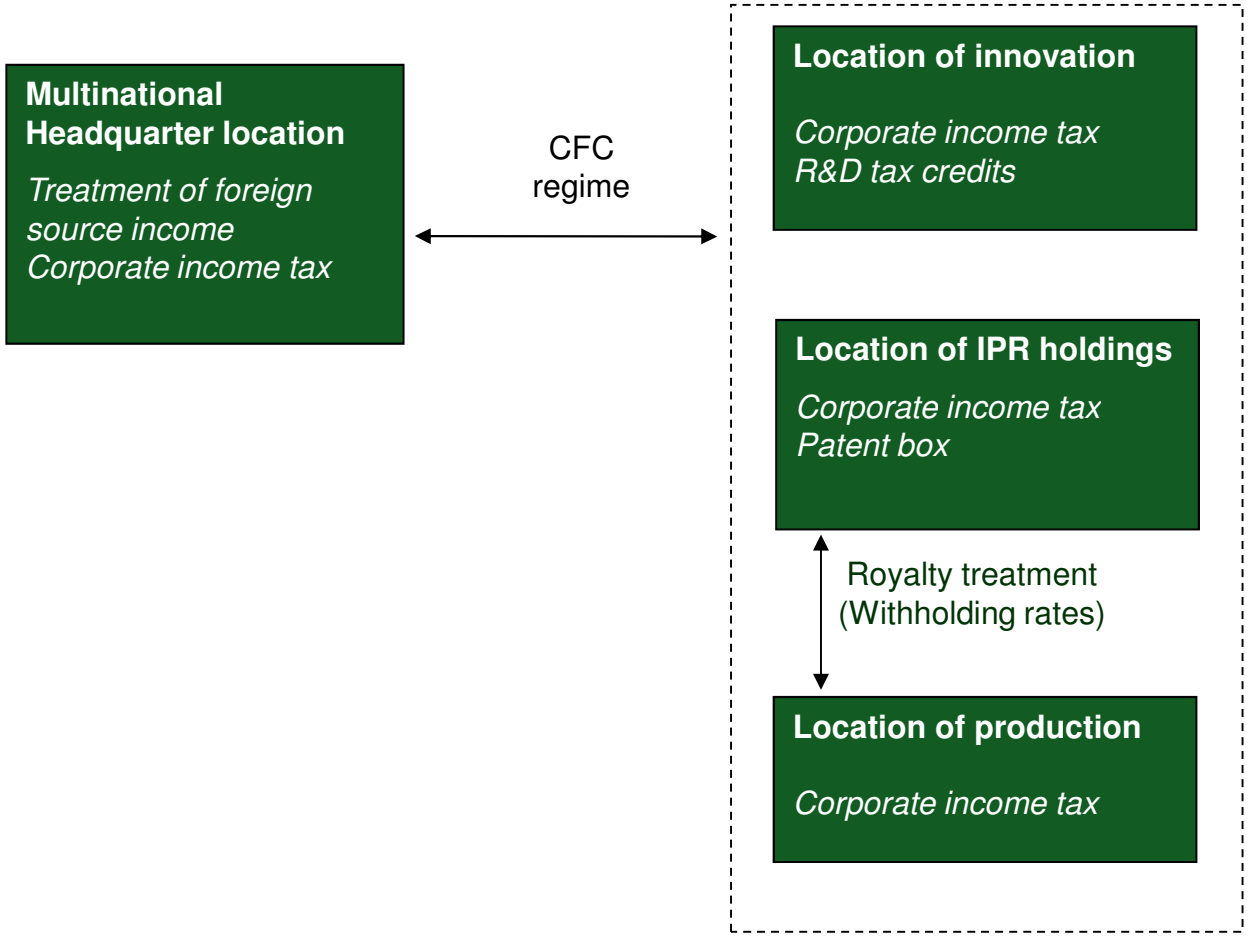
Patent Box as a preferential rate for mobile income

- Theoretical results predicated on underlying assumptions
  - Keen (2001) - a preferential regime improves revenues by isolating tax competition in one part of the tax system
  - Janeba and Peters (1999) - in equilibrium tax competition leads to no tax on mobile income and lowers all revenues for all governments
- Work to reconcile opposing results (e.g. Janeba and Smart (2003))
  - predictions depend on assumptions about elasticities of tax bases and form of strategic interactions
- Estimate elasticities and consider strategic government tax setting

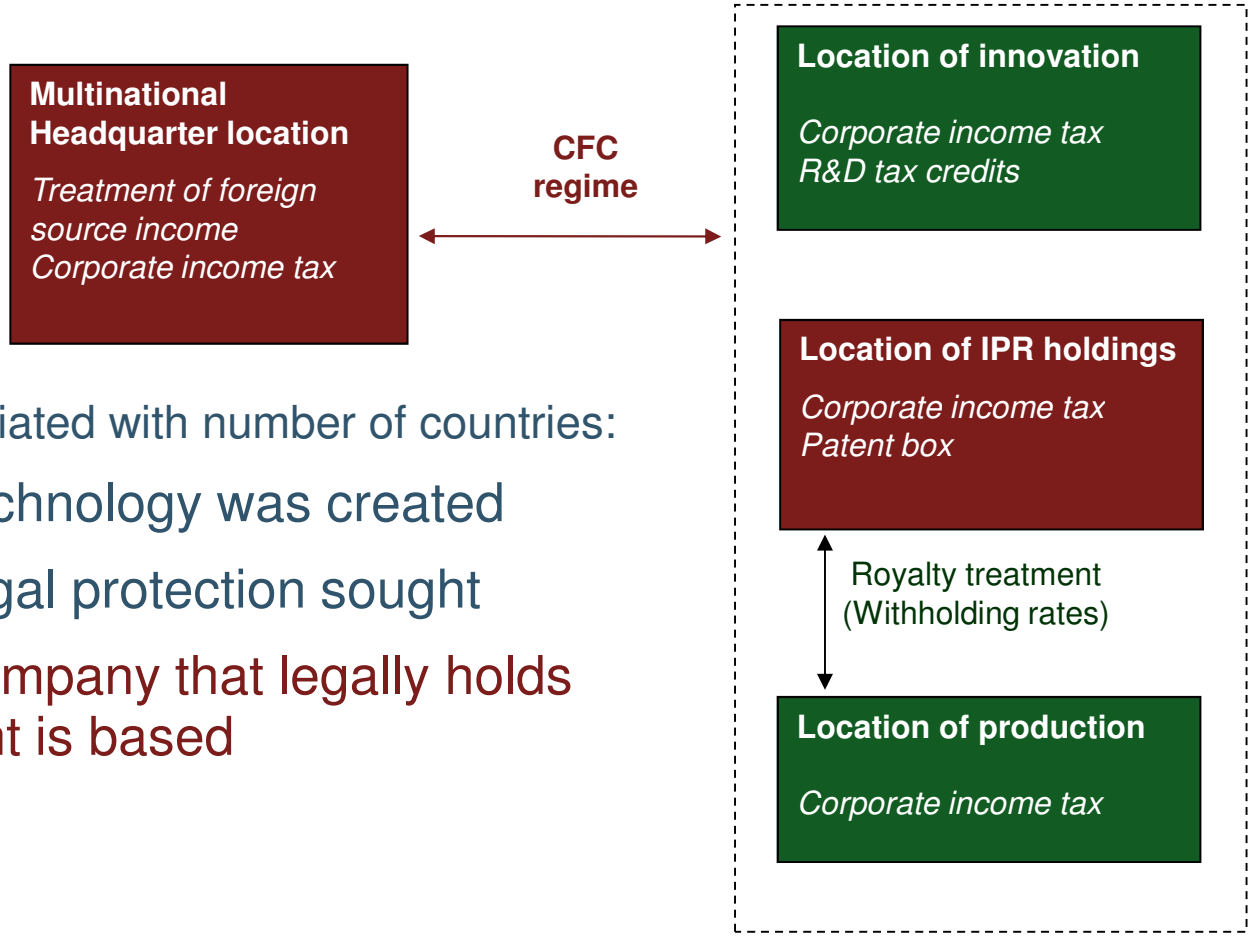
Corporate taxes & the location of intellectual property - Griffith, Miller and O'Connell (2011)

- Aim: provide empirical evidence on how responsive the location of IP is to corporate tax
  - model of firm location choice (drawing on discrete choice demand models used in the Industrial Organisation literature)
  - estimate the impact of corporate taxes on innovative European multinationals' choices over where to hold patents
  - explicitly allow for heterogeneity in where patents are located and how responsiveness such choices are to tax (random coefficients)
    - Previous research tends not to consider intellectual property
    - Tends to estimate single elasticity and produce restrictive substitution pattern

Firm behaviour - location and taxes



Firm behaviour - location and taxes



Patents associated with number of countries:

- where technology was created
- where legal protection sought
- where company that legally holds the patent is based

Firm behaviour - location and taxes

- Expect considerable heterogeneity in where patents are located and how responsive such choices are to tax
  - benefits and costs of choosing a lower tax location may differ with expected value of patent
  - firms face different costs of locating patent income - organisational structure; strategies; headquarter countries; markets.
  - non-tax characteristics of countries

- Allow for interactions in tax setting via Controlled Foreign Company (CFC) rules
  - Countries tax income which is deemed to be “passive” and held in a low tax country

Model of firm behaviour

- Firm has a successful discovery, decides which subsidiary should apply for the patent
  - the location of the subsidiary determines how the income will be taxed
- Value to firm of holding patent in a location depends on:
  - revenue from patent
  - cost to firm of holding patent in that subsidiary (mainly income taxes)
  - fixed costs of holding patent in that subsidiary
  - benefits that arise from holding patent in that location
- Firm chooses location where value is highest

Model of firm behaviour

- In year *t*, firm *i* chooses to hold patent *p* in the location *j* such that:

$$j_p^* = argmax_{j\epsilon\{1,\dots,J\}}\{(1-\tau_{ijt})\tilde{V}_p - C(\tilde{V}_p, X_i) - F_{ipj}\}$$

$\tilde{V}_p$	expected net present pre-tax value
τ_{ijt}	tax rate on patent income, including CFC regimes
$C(\tilde{V}_p, X_i)$	cost that firm *i* incurs when locating the patent
X_i	vector of firm characteristics
F_{ipj}	net fixed costs to firm *i* of locating patent *p* in location *j*,

Empirical specification

- Define patents according to 3 industry classifications, *r*, and 2 broad firm size categories, *s*

$$j_p^* = argmax_{j\in\{1,\ldots,J\}}\{\varphi_{ip} - \delta_p \tau_{ijt} - (\gamma_{rsj} + e_{ipj})\}$$

patent specific response to the tax rate: $\delta_p = \mu_{rs} + \sigma_{rs}\eta_p$

where $\eta_p \sim N(0,1)$ $e_{ipj} \sim i.i.d\ extreme\ value$

The random coefficient, η_p , allows for variation in responsiveness of location choice to tax along unobservable dimensions

Data: Firms and patents

- Location of Intellectual Property – data on EPO patent applications 1985-2005
  - address of subsidiary that made application
- Multinational firm ownership structure from accounts data
  - result: European parent firms and their patent applications held in European and US subsidiaries
  - Firms headquartered in 9 European countries (Belgium, Denmark, Finland, Ireland, Luxembourg, Netherlands, Norway, Sweden, and UK)
  - Chose amongst 15 locations (above plus France, Germany, Italy, Spain, Switzerland and US)

Data: corporate taxes

- statutory corporate rate in source country
  - Variation across countries and over time

- CFC regime operated in home country. (roughly) apply when:
  - parent firm owns a large enough share of an offshore subsidiary
  - a great enough proportion of the subsidiaries income arises from 'passive sources'
  - the subsidiary is located in a country deemed to be a low tax country – use rules define source countries deemed to be 'low tax' country

- observed Patent Boxes rates used in simulations
  - Patent Boxes are introduced after our data ends

Results; coefficients on corporate tax

	Multinomial logit	*Multinomial logit*	*Random coeff. logit*
	(1)	*(2)*	*(3)*
	Electrical Industry		
Large firms			
Tax rate, Mean	0.59	-3.17	**-5.01**
	(0.04)**	(0.09)**	**(0.12)****
Tax rate, Std Dev	-	-	**6.80**
	-	-	**(0.16)****
Medium firms			
Tax rate, Mean	-1.11	-4.48	**-5.17**
	(.08)**	(0.19)**	**(0.27)****
Tax rate, Std Dev	-	-	**3.52**
	-	-	**(0.51)****
Industry-firm size specific country fixed effects	no	yes	**yes**

Results; coefficients on corporate tax

	Multinomial logit	*Multinomial logit*	*Random coeff. logit*
	(1)	*(2)*	*(3)*
	Chemical Industry		
Large firms			
Tax rate, Mean	-0.04	-1.42	**-4.00**
	(0.04)	(0.09)**	**(0.14)****
Tax rate, Std Dev	-	-	**8.85**
	-	-	**(0.20)****
Medium firms			
Tax rate, Mean	-0.55	-2.67	**-3.30**
	(0.08)**	(0.18)**	**(0.22)****
Tax rate, Std Dev	-	-	**4.06**
	-	-	**(0.39)****
Industry-firm size specific country fixed effects	no	yes	**yes**

Results; coefficients on corporate tax

	Multinomial logit	*Multinomial logit*	*Random coeff. logit*
	(1)	*(2)*	*(3)*
	Engineering industry		
Large firms			
Tax rate, Mean	0.44	-1.80	**-2.60**
	(0.05)**	(0.11)**	**(0.13)****
Tax rate, Std Dev	-	-	**4.66**
	-	-	**(0.23)****
Medium firms			
Tax rate, Mean	-0.15	-2.98	**-3.76**
	(0.07)*	(0.16)**	**(0.21)****
Tax rate, Std Dev	-	-	**4.20**
	-	-	**(0.39)****
Industry-firm size specific country fixed effects	no	yes	**yes**

Own and cross tax elasticities market elasticities

	Country changing tax rate														
Location country	Belgium	Denmark	Finland	France	Germany	Ireland	Italy	Luxembourg	Netherlands	Norway	Spain	Sweden	Switzerland	UK	US
Belgium	**-1.006**	0.031	0.051	0.171	0.026	0.001	0.042	0.006	0.168	0.006	0.004	0.080	0.111	0.143	-0.012
Denmark	0.064	**-1.375**	0.056	0.261	0.076	0.001	0.089	0.011	0.228	0.011	0.007	0.109	0.193	0.257	0.038
Finland	0.055	0.030	**-1.568**	0.471	0.112	0.001	0.062	0.005	0.486	0.006	0.004	0.193	0.147	0.202	0.054
France	0.030	0.023	0.077	**-0.917**	0.035	0.000	0.031	0.003	0.232	0.004	0.002	0.097	0.095	0.124	0.000
Germany	0.011	0.016	0.046	0.087	**-0.642**	0.000	0.016	0.003	0.109	0.004	0.002	0.060	0.069	0.080	-0.053
Ireland	0.082	0.081	0.083	0.311	0.094	**-0.768**	0.129	0.017	0.252	0.016	0.014	0.136	0.461	0.318	0.053
Italy	0.028	0.029	0.038	0.117	0.025	0.001	**-0.842**	0.008	0.089	0.008	0.005	0.064	0.091	0.132	-0.014
Luxembourg	0.058	0.056	0.045	0.194	0.074	0.001	0.124	**-1.299**	0.129	0.013	0.010	0.089	0.160	0.242	0.028
Netherlands	0.038	0.025	0.103	0.301	0.056	0.000	0.030	0.003	**-1.067**	0.004	0.002	0.124	0.116	0.148	0.018
Norway	0.061	0.055	0.056	0.249	0.085	0.001	0.115	0.013	0.183	**-1.340**	0.008	0.105	0.168	0.242	0.039
Spain	0.043	0.041	0.040	0.148	0.052	0.001	0.097	0.012	0.090	0.010	**-1.081**	0.068	0.099	0.171	0.018
Sweden	0.052	0.035	0.119	0.365	0.090	0.001	0.063	0.006	0.359	0.007	0.004	**-1.405**	0.146	0.196	0.043
Switzerland	0.069	0.061	0.085	0.336	0.094	0.002	0.087	0.010	0.316	0.011	0.005	0.140	**-0.857**	0.276	0.052
UK	0.052	0.046	0.069	0.258	0.067	0.001	0.073	0.008	0.239	0.009	0.005	0.109	0.160	**-1.181**	0.026
US	-0.007	0.012	0.031	-0.001	-0.075	0.000	-0.013	0.002	0.048	0.002	0.001	0.040	0.058	0.044	**-0.266**

Market elasticities (subset of countries)

Location country	***Country changing tax rate***						
	Belgium	France	Ireland	Luxembourg	Netherlands	Sweden	UK
Belgium	**-1.006**	0.171	0.001	0.006	0.168	0.080	0.143
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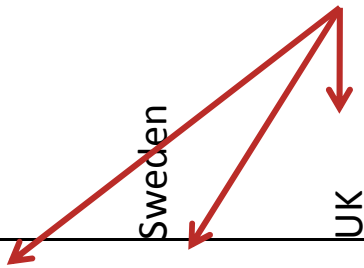
Elasticities

- In the random coefficients model the cross tax elasticities vary across countries
  - they depend on the countries' characteristics and how close they are to each other; countries that have more similar characteristics will be seen as closer substitutes by firms, and therefore the cross tax elasticity will be higher
- In a standard logit model the cross tax elasticities would be the same within each column
  - the cross-tax elasticity in the simple logit model is a function of only the tax rate in the country that is adjusting its tax rate, the share of that country and the coefficient on the tax rate, which is constant across countries

Table 9 market elasticities; *standard logit* model

Less elastic demand; unrealistic substitution patterns



	Country changing tax rate						
Location country	Belgium	France	Ireland	Luxembourg	Netherlands	Sweden	UK
Belgium	**-0.816**	0.173	0.001	0.003	0.130	0.049	0.090
France	0.031	**-0.671**	0.001	0.003	0.130	0.049	0.090
Ireland	0.031	0.173	**-0.311**	0.003	0.130	0.049	0.090
Luxembourg	0.031	0.173	0.001	**-0.755**	0.130	0.049	0.090
Netherlands	0.031	0.173	0.001	0.003	**-0.656**	0.049	0.090
Sweden	0.031	0.173	0.001	0.003	0.130	**-0.649**	0.090
UK	0.031	0.173	0.001	0.003	0.130	0.049	**-0.658**

Government tax setting

- Aim going forward: model a process of strategic government tax setting to consider the effects of setting preferential rates for mobile income
  - simple model of revenue maximising governments
  - many, asymmetric countries
  - alternative assumptions on the form of governments' strategic behaviour

- Are Patent Boxes the beginning of harmful tax competition? Would coordination be better?

- For now: What are the effects of Patent Boxes, before other governments respond?

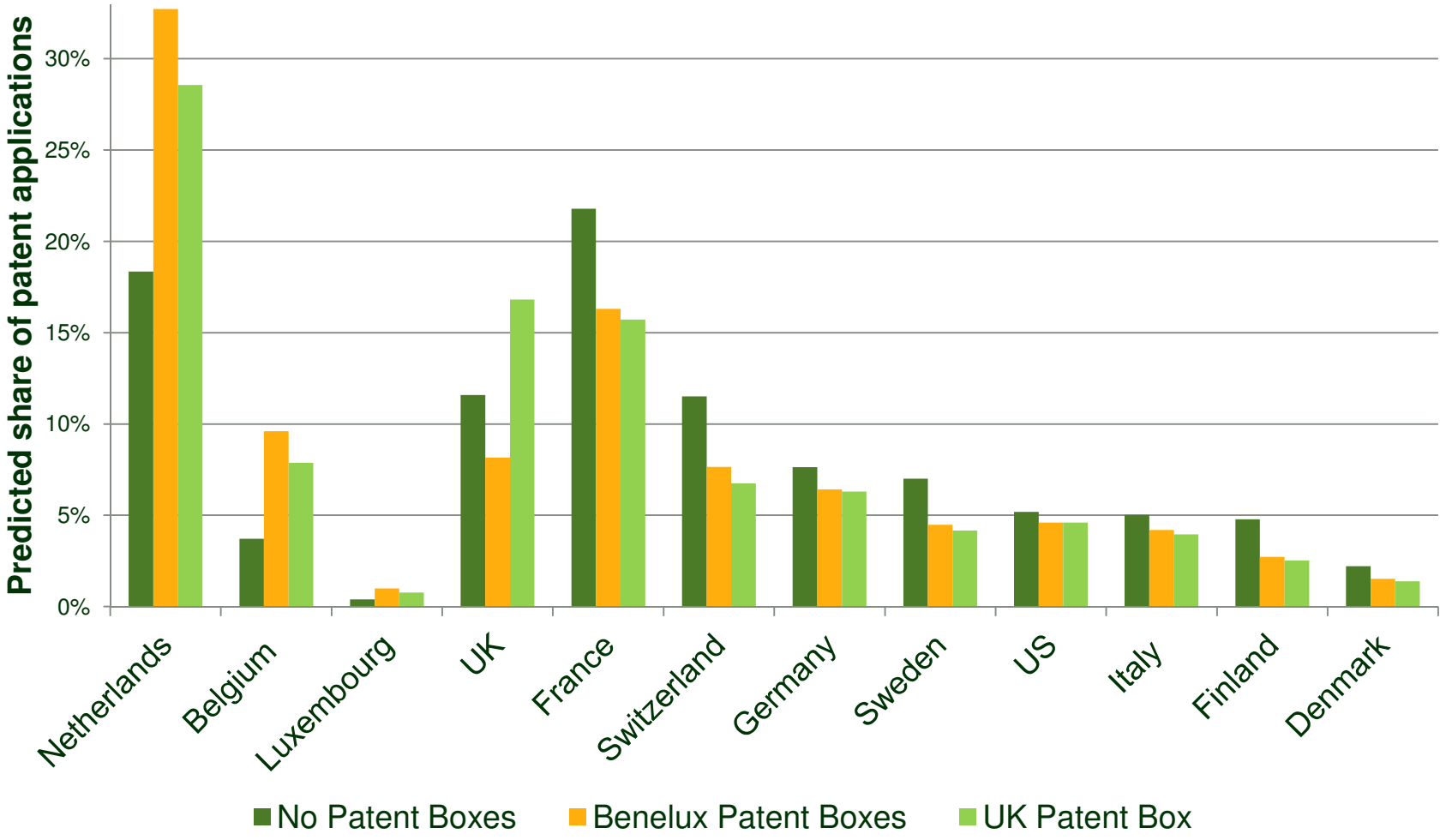
Counterfactual policy analysis

- **How do Benelux Patent Boxes affect where patents are held?**
  - *increase share of patents held in Benelux countries*
  - *fall in UK share (12% -8%) , and elsewhere*

- **How does a UK Patent Box affect where patents are held?**
  - *fall in Benelux countries' share (still higher than before)*
  - *increase in UK share (to 17%)*

- **Government revenue from patent income falls in all countries**
  - *function of the share of patent income held in a country and the relevant tax rate.*

Patent box simulations (shares in each country)



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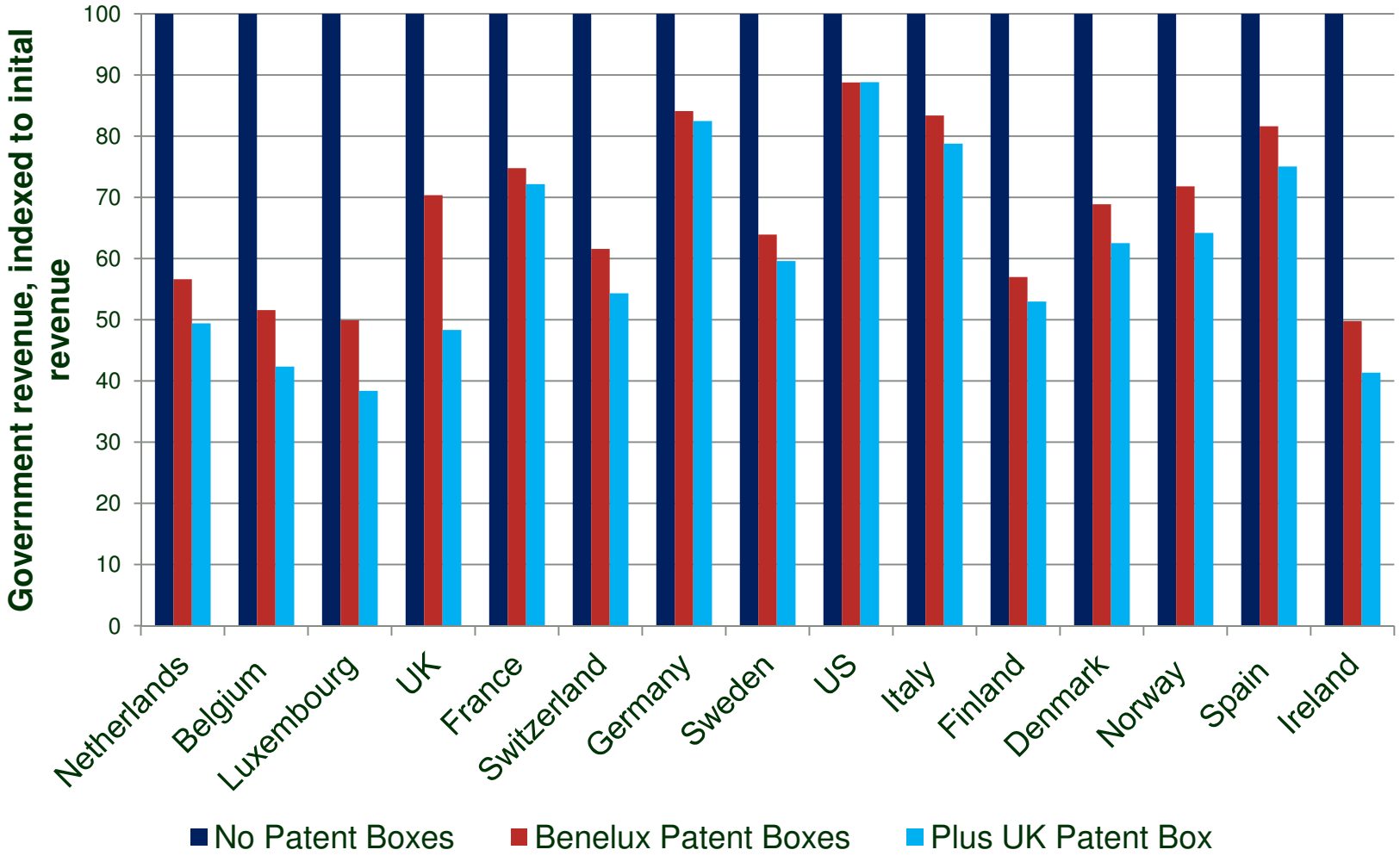
Tax revenue

- Government revenue from patent income,
  - function of the share of patent income held in a country and the relevant tax rate.
- Expect fall in revenue in non-Patent Box countries
- In other countries, revenue depends on whether increase in share of income outweighs lower tax rate applied to income

Tax revenue (indexed to 100 before Patent Boxes)



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Model of firm behaviour; summary

- Tax does affect location of patent holding
  - important to account for interactions between tax jurisdictions
  - significant heterogeneity the responsiveness of patents' location to tax (including important variation along unobserved characteristics)
  - More realistic substitution patterns that previous models
  - *Going forward - extend to make estimates more flexible*

- Patent Boxes work to attract firms' patent holdings but lead to a loss in revenue
  - Not accounting for other benefits
  - Expect other governments to respond – harmful tax competition?