



ALMA MATER STUDIORUM  
UNIVERSITÀ DI BOLOGNA

# Innovation and inequality. A Schumpeterian look at the skill premium

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# Part I

## The theory



## Background 1/4

- The relationships between technical change and inequality have been the focus of a relevant and huge literature
- The bulk of which is constituted by the skill-biased technical change hypothesis
- It seems quite obvious in fact to relate the technological level of a country to the skill level of its workers
- As the level of technological change of an economic system increases, firms will need workers with a higher skill level to deal with the new technology
- As technical change was seen predominantly in the use of personal computers, a skill bias technical change emerged as computers became widely adopted



## Background 2/4

- Starting from the seminal work of Krueger (1993), a stream of literature has produced lot of empirical analysis
- In the period 1970-1989, in front of an average growth of weekly wages of working men in US of about 20%, the least skilled obtained a mere 5% increase, while the most skilled got a 40% increase in the same period of time
- As a result, in 1989 wages were 15% higher than in 1970 for the latter category of workers, and 5% lower for the former one



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- As a result, in 1989 wages were 15% higher than in 1970 for the latter category of workers, and 5% lower for the former one
- A more recent stream of literature has emphasised the role of the content of the different job tasks rather than the 'simple' skilled/unskilled dichotomy in explaining inequality patterns in wages



## Background 3/4

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- Innovators destroy the prevailing equilibrium and are rewarded with monopoly profits
  - Inequality increases



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- Thus, inequality depends on the type of innovation that is produced
- Moreover, we all know the difference between input and output of innovative activity



## Background 3/4

- As the level of R&D is low firms' profits are low and there is no room for rent sharing between the employers and the workers.
- As R&D increases the monopolistic rents tend to increase. Highly skilled workers appropriate a larger quota of the rent than the low skilled ones. As a result, the wage premium increases.
- However as R&D increases knowledge spreads and spill over effects start to work. Competition among firms becomes tougher and tougher. As a result, there is a decrease in the monopolistic rent and a consequent decrease in the wage premium.
- The relation between R&D and the wage premium is non linear and non monotonic. Graphically, it is an inverted U shaped relation. Concave function.



## Background 3/4

- The story for patents is different. When you have few patents, imitation is easy. Competition among firms is tough. This results into a low level of wage premium.
- As the amount of patent increases innovative activities become more and more complex and difficult to imitate. The rent augments giving rise to an increase in the wage premium.
- The relation between patents and the wage premium is also non linear and non monotonic. Graphically, it is a U shaped relation. Convex function.



## Background 4/4

- In the scope of labour markets analysis a lot of diverse approaches have been developed aimed at explaining the dynamics of inequality in income distribution
- Human capital theories (Becker, 1964, Mincer, 1974, Chapman, 1993, Lazear, 2009)
- Institutional theories (Thurow, 1975, Doeringer, Piore, 1971); Labour market segmentation
- Skill-biased technical change (Acemoglu, 1998, 2002)
- Polarisation of labour markets based on the task approach (Autor, Dorn, 2013)
- Employer-size wage premium (Oi, Idson, 1999, Hamermesh, 1980, Lallemand, Rycx, 2007)



## Part II

### The empirics



# Dataset and Methodology

- Longitudinal panel made of 9 countries for the period 2000-2015
- Dependent variable
  - Skill premium - EU KLEMS
    - Ratio between the proportion of labour compensations (LHS) to the hours worked by high-skilled workers (WHS) and the same proportion for low-skilled worker (LLS and WLS respectively):  $SP = \frac{LHS}{WHS} / \frac{LLS}{WLS}$
- Main variables
  - R&D - OECD STI
  - Patents - WIPO
- Co-variates
  - Trade indicators and FDI - World Bank Open Data
  - Labour market indicators - ILO Stat (SDG labour market indicators)
  - Top income tax rate - World Inequality Database
  - Herfindahl Index - WITS World Bank
- Panel estimation Fixed effects (Hausman test confirms)



## Full sample 2000-2015

|                            |           |           |
|----------------------------|-----------|-----------|
| Total R&D                  | 0.349*    | 0.333*    |
| Total R&D <sup>2</sup>     | -0.580*** | -0.463*** |
| Patent grants              | -0.554*** | -0.330*   |
| Patent grants <sup>2</sup> | 0.0276**  | 0.0164    |
| Imports                    | 0.584**   | 0.766***  |
| FDI                        | 0.00885   | 0.00988   |
| Labour Productivity        | 0.593*    | 0.330     |
| HH index                   | -0.0342   | 0.0105    |
| Firms > 250                | -0.122**  | -0.0781   |
| Workers HE                 | -0.258    | -0.730*** |
| Unemployment               |           | 0.141***  |
| Top Income Tax Rate        |           | 0.186     |
| High fem participation     |           | 0.00508   |
| High empl protection       |           | -0.0292   |
| Const                      | 5.829***  | 5.144***  |
| Time dummies               | Yes       | Yes       |
| N                          | 136       | 120       |

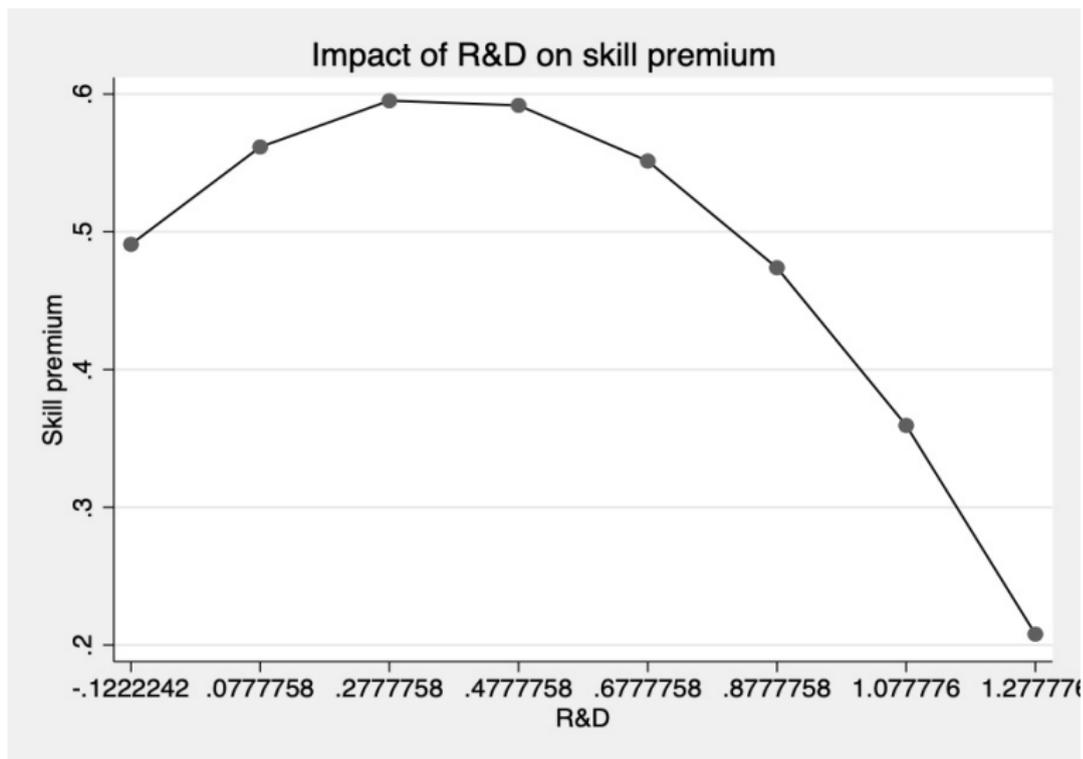
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## Inequality and innovation - R&D

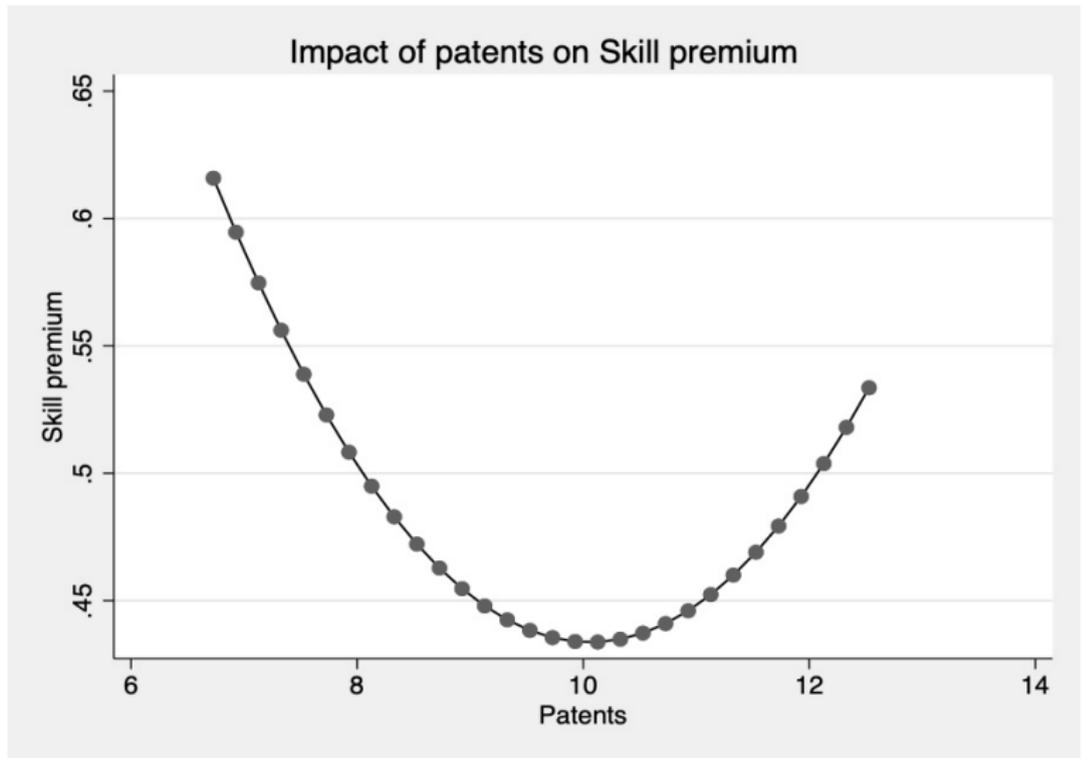


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# Inequality and innovation - Patents



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## GMM Arellano Bond

|                            |            |          |
|----------------------------|------------|----------|
| Total R&D                  | 0.2510*    | (0.1286) |
| Total R&D <sup>2</sup>     | -0.4086*** | (0.0693) |
| Patent grants              | -0.2841**  | (0.1177) |
| Patent grants <sup>2</sup> | 0.0177***  | (0.0061) |
| Imports                    | 0.6644***  | (0.0778) |
| FDI                        | 0.0014     | (0.0021) |
| Labour Productivity        | 0.1179     | (0.2040) |
| HH index                   | 0.0254     | (0.0474) |
| Firms > 250                | 0.0296     | (0.0200) |
| Workers HE                 | -0.6198*** | (0.1714) |
| Unemployment               | 0.1446***  | (0.0266) |
| Top Income Tax Rate        | 0.1677     | (0.1229) |
| High fem participation     | 0.0365***  | (0.0137) |
| High empl protection       | 0.0005     | (0.0141) |
| Time dummies               | Yes        |          |
| <i>N</i>                   | 89         |          |

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## Effect of 2008 crisis

|                            |           |           |           |
|----------------------------|-----------|-----------|-----------|
| Total R&D                  | 0.260*    | 0.340**   | 0.263*    |
| Total R&D <sup>2</sup>     | -0.456*** | -0.553*** | -0.460*** |
| Patent grants              | -0.358**  | -0.314*   | -0.352**  |
| Patent grants <sup>2</sup> | 0.0171*   | 0.0149    | 0.0164    |
| Imports                    | 0.396**   | 0.358**   | 0.382**   |
| FDI                        | 0.00521   | 0.00567   | 0.00514   |
| Labour Productivity        | 0.226     | 0.249     | 0.234     |
| HH index                   | 0.138*    | 0.130*    | 0.143*    |
| Firms > 250                | -0.0600   | -0.0430   | -0.0578   |
| Workers HE                 | -0.891*** | -0.829*** | -0.873*** |
| Unemployment               | 0.128***  | 0.133***  | 0.126***  |
| Top Income Tax Rate        | 0.00219   | 0.0239    | 0.00396   |
| High fem participation     | 0.00487   | 0.00393   | 0.0114    |
| High empl protection       | -0.0422   | -0.0426   | -0.0412   |
| Recession                  | 0.0472**  |           |           |
| Recession * R&D            |           | 0.0627**  |           |
| Recession * Patents        |           |           | 0.00533** |
| Const                      | 6.371***  | 5.975***  | 6.345***  |
| <i>N</i>                   | 120       | 120       | 120       |

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# Some considerations



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- ☑ Large R&D activity spills over in the economy  
(e.g. easy to appropriate)
  - ☑ Few Patents are easy to imitate  
(e.g. relatively less complex)



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- ☞  $\frac{\text{LowR\&D}}{\text{HighPAT}} \Rightarrow \text{High inequality}$



## Some considerations

☞  $\frac{HighR\&D}{LowPAT} \Rightarrow Low\ inequality$

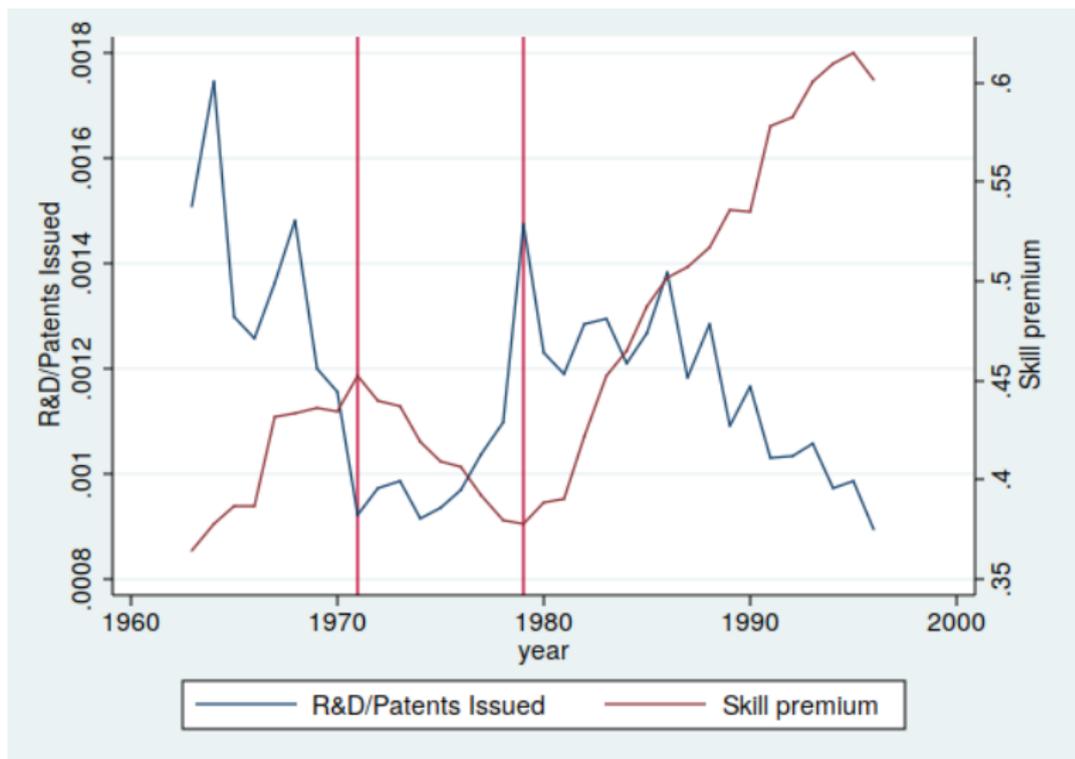
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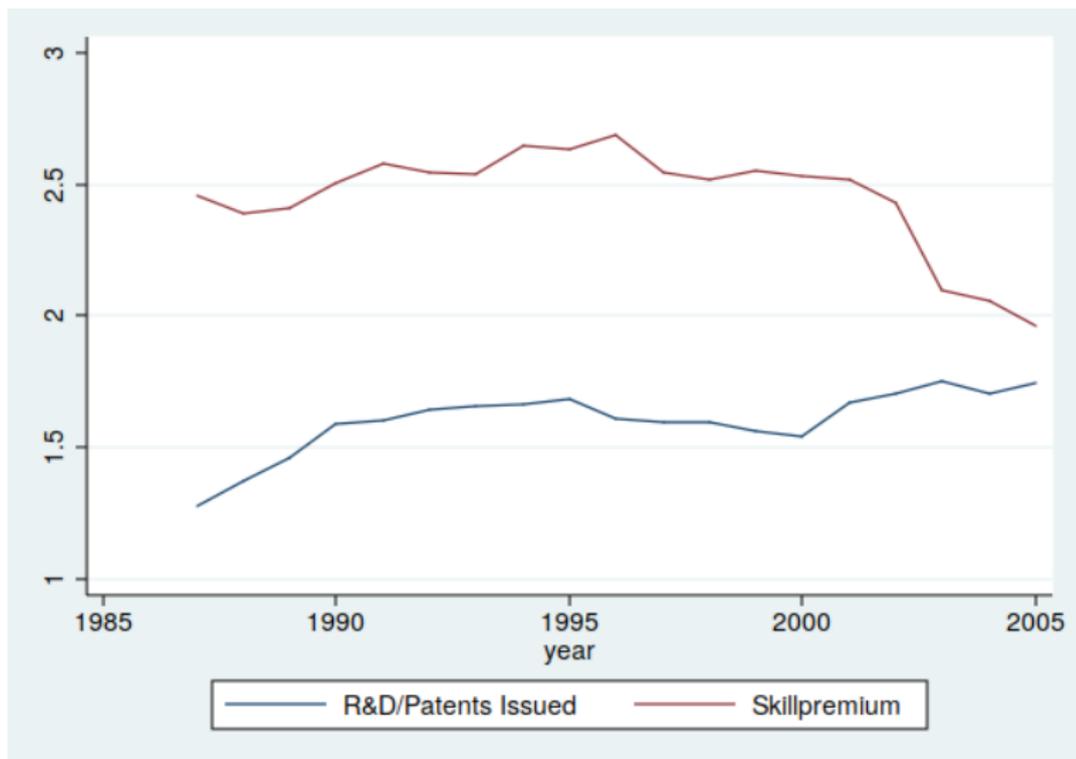
- ☑ Little R&D is easier to appropriate  
(e.g. easy to keep it secret)
- ☑ Many Patents imply relatively more complex technologies  
(e.g. high absorptive capacity needed)



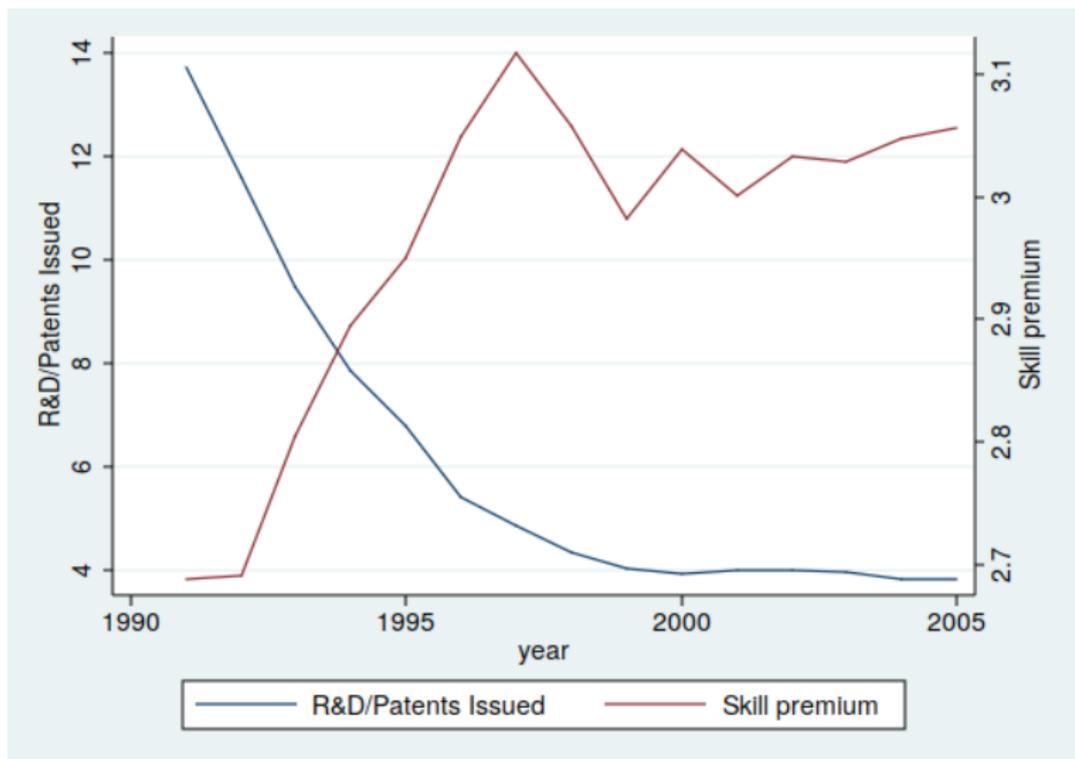
## US — Innovative activity and skill premium



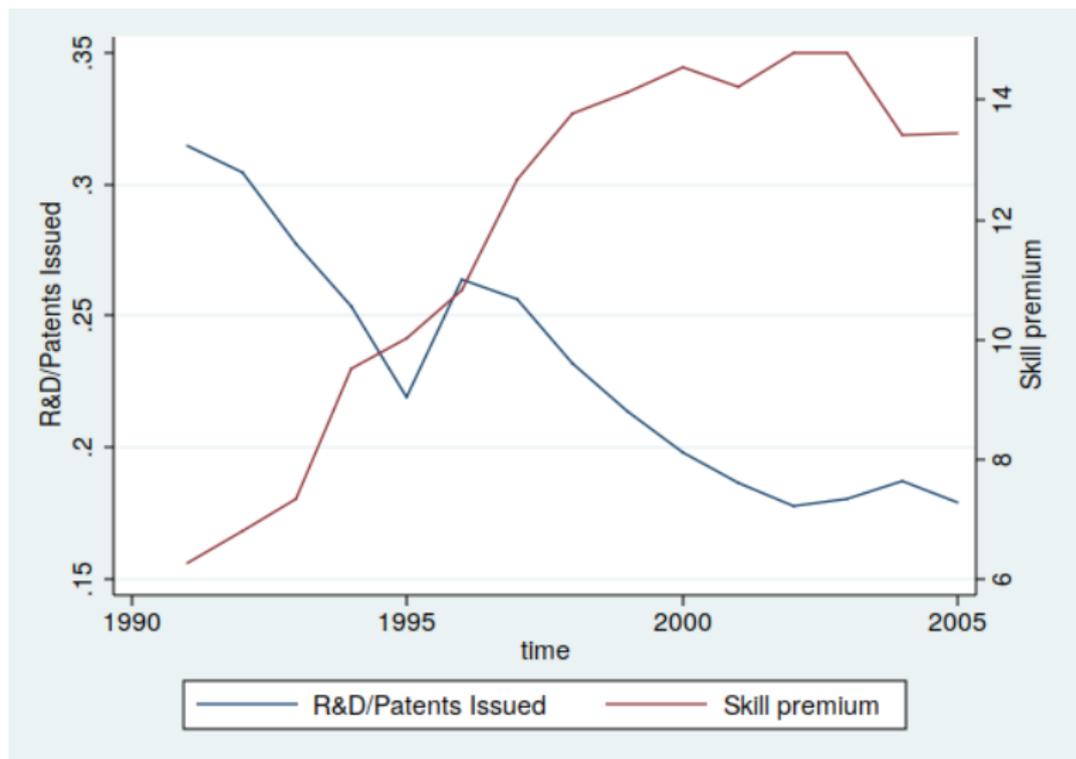
## France — Innovative activity and skill premium



## Germany — Innovative activity and skill premium



## UK — Innovative activity and skill premium





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