Innovation, the firm and the market

Topic 2

Dr E. Walkowiak

Agenda

- A “simple” microeconomic approach of innovation
  - Centred on the firm
  - Centred on the market
- Standards and competition
- Policy issues (competition policy)

References

Essential readings

- Handbook, chapter 2
- David P.A., (1985) : « Clio and the economics of QWERTY », *American Economic Review*, 75, 332-37.

Additional references

- Dosi G., (1988) : « Sources, Procedures, and Microeconomic Effects of Innovation », *Journal of Economic Literature*, 26, p. 1120-1171.
- Hill, C.W.L. (1997) 'Establishing a standard: Competitive strategy and technological standards in winner-take-all industries', *The Academy of Management Executive*, 11 (2), 7-25.
- Nelson R., Winter S., (1982) : *An Evolutionnary Theory of Economic Change*, Pinter.
- Shapiro, C. And Varian, H.R. (1999) 'The Art of Standards Wars', *California Management Review*, 41 (2), 8-32.

Innovative firms

Which global company do you consider as the most innovative ? BCG survey, 2016

https://www.bcgperspectives.com/most-innovative-companies-2016/

- Apple has been number one every year since 2005.
- Google, which ranked number two from 2006 to 2012

Innovation and firms

Reasons to innovate:

- Economics literature:

  Motive: it maximises current/future profits

  R&D is investment yielding future returns
- Management literature

  To ensure survival of the firm

  To increase market share

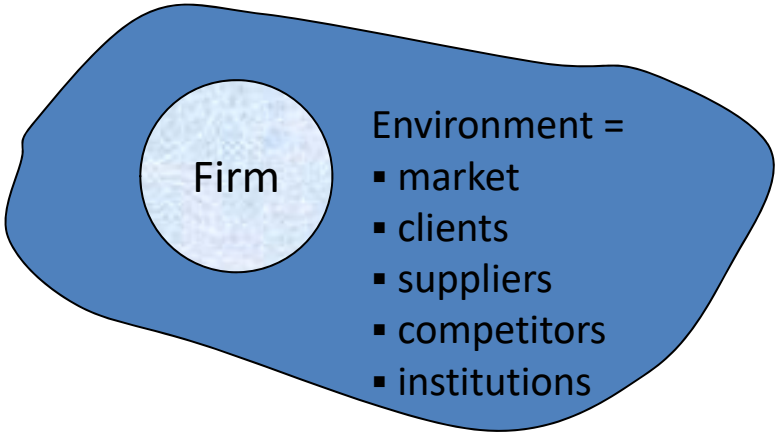
  To satisfy customers
- Choice of being leader or follower

Approach centred on the firm

Approach centred on the market

A SIMPLE MICROECONOMIC MODEL OF INNOVATION

- Microeconomic approach centred on the firm



WHY does a firm innovate (or not) ?

Incentives
- differenciation (to avoid price competition) collaboration

Obstacles
- fixed cost

How does a firm innovate?

Internal Ressources
- information
- HR

… external
- external financing
-partnership,

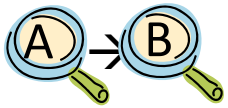
- Microeconomic approach centred on the market

Efficiency of the market as a coordination mechanism, does the market lead to an innovation behaviour which is socially optimal?

Two micro approaches

Neoclassical

- behaviors perfectly rational (Max Π)
- perfect (asymmetric) information
- Risky future (probabilistic scenarios)
- technology = strategic variable at the equilibrium (efficient directly when it is implemented)



Ex.
Kamien M., Schwarz N., (1982) : *Market Structure and Innovation*, Cambridge.

WHY ?

Evolutionist

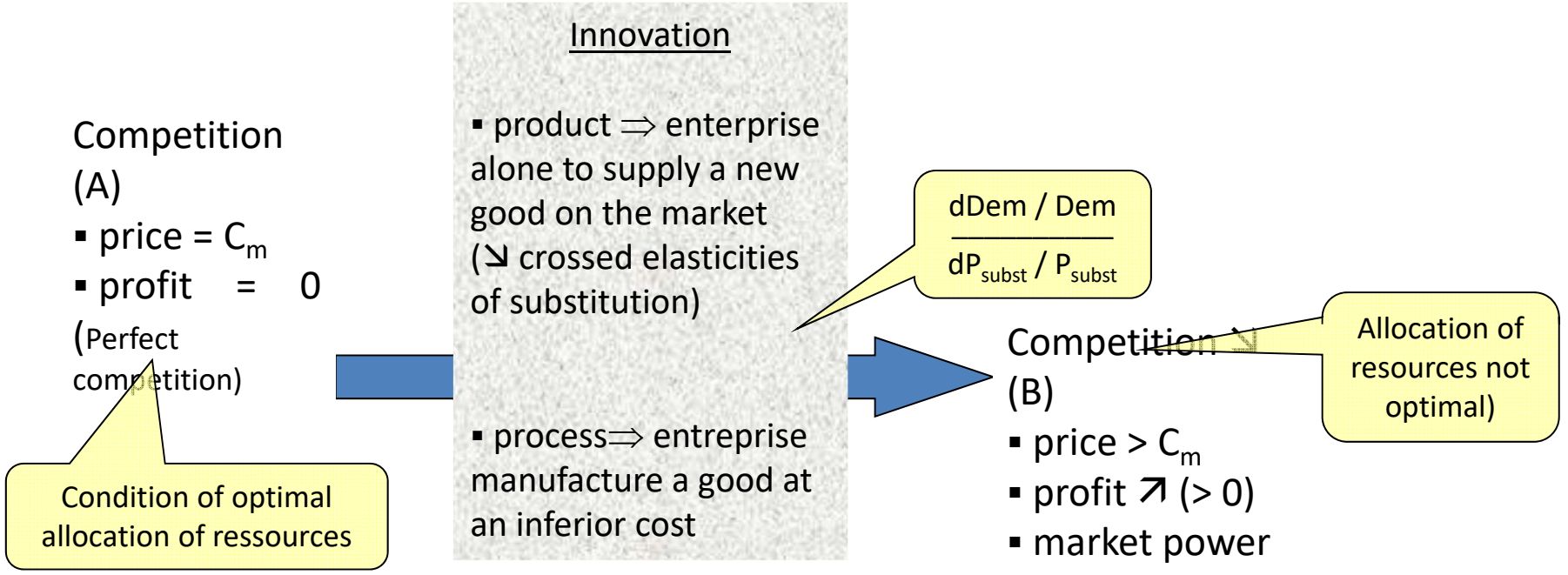
- limited/ procedural rationality (ex. research of satisfaction)
- imperfect information (i.e. incomplete)
- uncertain future
- technology = strategic variable out of the equilibrium

Ex.
Nelson R., Winter S., (1982) : *An Evolutionnary Theory of Economic Change*, Pinter.
Dosi G., (1988) : « Sources, Procedures, and Microeconomic Effects of Innovation », *Journal of Economic Literature*, 26, p. 1120-1171.

HOW ?

Innovate to avoid competition

An enterprise innovates if it net gain is positive – or expect a positive net gain (benefit > cost)



Cost of innovation $\leq \Delta\Pi \Leftrightarrow$ ***enterprise innovates***

But competition comes back

↗ profit associated with innovation is temporary :
- imitation by competitors
- innovation of competitors (effective or potential ; ex. competition Boeing – Airbus on the market of long haul airplanes)

Different possibilities available for the innovator to protect from imitation and extend the period of monopoly :
- complexity of the product
- secrecy (more for process than product)
- patent (more for product that process)

… but, most importantly, continue to innovate (pour sustain an advance on imitators)

Cost of innovation

Fixed cost = largely independant of the quantity produced of new good (ex. R&D to develop a new mobile phone)

NB : no innovation without abnormal profit to reimburse this fixed cost

Scale economies :

- fixed costs of innovation are even better amortized for large demand
- *learning by doing* = quality / efficiency increase with the volume of demand

Sunk cost =

- generally, equipements, teams, and results of an innovation project are specific to an innovator
- sell this asset is difficult in case of failure of the project

Gains of innovation

Distribution of gains between different innovators can be strongly asymetric on the markets of innovative products

Extreme case = race for patent (for ex, to discover a new medication) :

- many enterprises invest in R&D to discover a molecule
- the first to find patent the invention and monopolizes the market
- a pure lost of other firms which invested

Other case = race for quality (vertical differentiation) :

- many enterprises invest in R&D to improve the quality of competing goods
- the one which increases the more substantially the quality « destroys » partly the gains of its competitor (which has to decrease the price because of a lower quality)

Uncertainty of innovation

Uncertainty concerns several parameters of the innovation process ; it is even more important when the innovation is far from what exists
(incremental → majeure → radical)

Difficult to anticipate :

- the chances of success of a technique, the cost & the time spent to find it
- commercial success = will the new good match the expected market ?
- reaction of competitors (imitation ? innovation ? With which intensity ? Which strategy ?)

For example, some figures (Mansfield (1971) on electrical, pharmaceutical and chemical industries:

- the rate of technical success of R&D project is between 52% – 68%
- but the rate of commercial success is between 8% - 29%

Technological opportunities

Differences in the fertility of different technical fields to produce innovations
ex microelectronics that offers a very fertile paradigm for decades following the path of miniaturization

Technological opportunities in a given field = potential technical progress

ex. of formalization (process innovation) $\gamma = dC_A/C_A \,/\, dRD/RD$

elasticity of average cost of production related to expenditures in R&D (to reduce it)

potential γ important $\Leftrightarrow$ a small investment in R&D generates important innovation measured by a decrease in the average cost

Ex : High Technological opportunities in the field of genetic therapy

Technological opportunities
- highly exogenous for innovators
- shaped by scientific advances (ex, discovery of DNA, recombinant DNA, etc.)

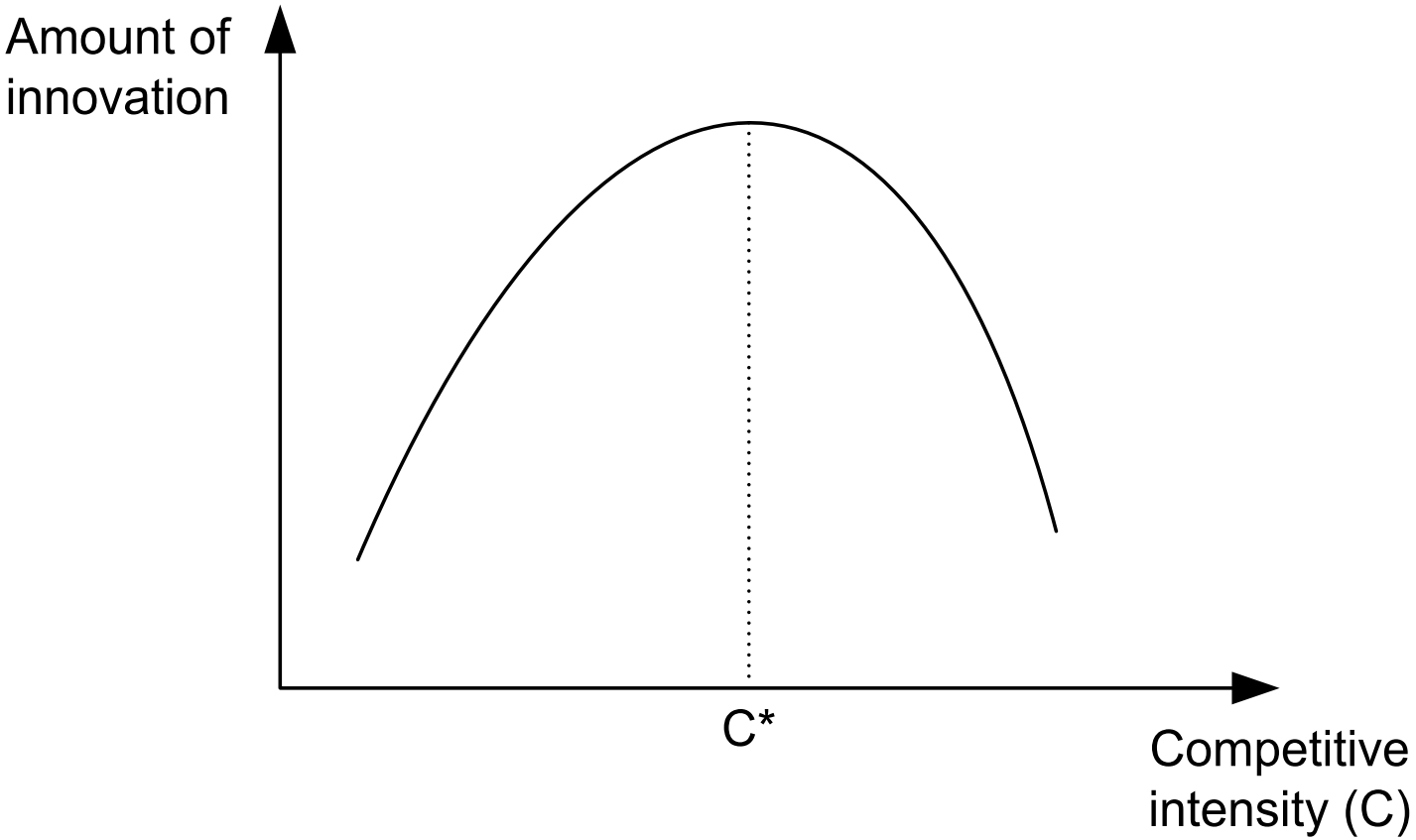
The importance of market power

Schumpeter's first hypothesis was that firms with *larger market shares* should innovate more

- Large market share gives more certainty about recouping returns to R&D once innovation occurs
- It also implies more current profits to finance the expenditure on R&D

- This hypothesis has led to substantial theoretical and empirical work on the relationship between market structure, competition and innovation
- Possible there is an inverted U-shaped relationship (see next slide), but economists cannot yet identify the optimal degree of competition C*

Inverted U-shape between innovation and competition



The importance of absolute size

Schumpeter's second hypothesis was that *larger firms* should innovate more

- Large size implies diversification of R&D risks and ability to finance

Empirical evidence on this second hypothesis is mixed:

- Large firms are more likely to do R&D or be IP active
- But smaller firms that are R&D or IP active have higher intensities of such activity

STANDARDS AND COMPETITION

Competitive Strategy and standard

- The ability of a firm to establish its technology as an industry standard has become a key determinant of its long term competitiveness.
- Consumer electronics, computer hardware and software, and telecommunications are some of the industries in which standards are important.
- Success of Microsoft (windows) and Intel – Wintel.

For a firm to design a competitive strategy, it must understand:

- Why Standards are important?
- What are the conditions that would lead to adoption of a particular technology as industry standard?

Standards

Why QWERTY ?

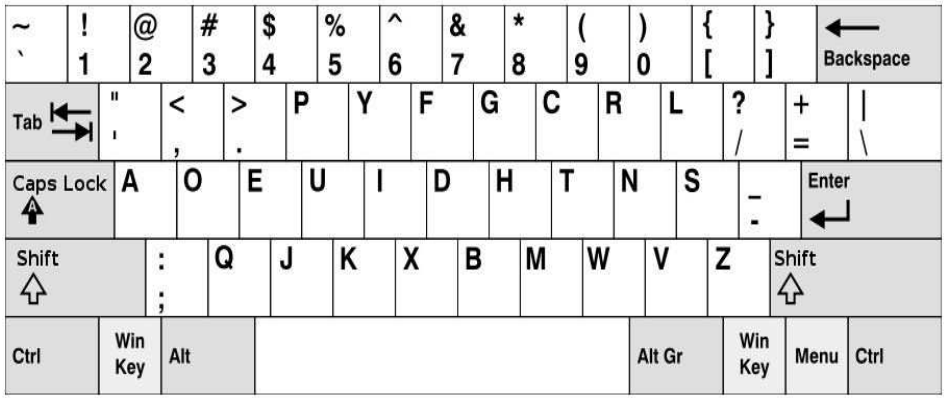
- The most ergonomically efficient keyboard layout? – No.
- The only technically feasible layout? – No.
- The cheapest layout to produce? – No.

Standards

Have you ever heard of it???

- Patented in 1932
- World record in speed typing
- 1940's experiment by U.S. Navy showed that increased efficiency obtained with DSK compared to QWERTY would amortize costs of retraining typists within 10 days of subsequent full-time employment
- Offered as alternative layout on Apple and Microsoft for decades
- But have you ever heard of it???

Dvorak Simplified Keyboard (DSK)



Standards

- Patented 1867 by Christopher Latham Sholes, the 52nd man to invent the typewriter
- Since 1873 produced by Remington and Sons, a famous arms makers in the US
- Typebar clashs and jams led to the development of QWERTY layout

Original prototype of QWERTY typewriter

Source: By George Iles [Public domain], via Wikimedia Commons
https://commons.wikimedia.org/wiki/File%3ASholes_typewriter.jpg

Standards
David (1985)

1. Technical interrelatedness: indirect network externalities
2. Demand-side economies of scale: direct network externalities
3. Quasi-irreversibility of investment

Dynamic of competition

- Network externalities
  Utility of each consumer depends positively on the number of other consumers of the same product

  Examples: ?
- This leads to many interesting features in market analysis:

– Critical mass
– Lock-in (at a high adoption / low adoption eqilibrium)
– Winner-takes-all markets (importance of small events!)
– Market failures (market power, direct and inderct network externalities, etc)

Strategy of firms

- The central decision of firms:

– Either compete *against system of rival(s) – Standards war:*

  - No compatibility, no links between systems
  - Users of one system do not have access to services / products / users of competing systems

– Or compete *within system of rival(s)*

  - Compatibility of systems, links or adapters – which standard?
  - Customers of one firm have access to services / products / users of competing firm(s)
  - Relevant size of the *network is number of customer of all firms* producing within a particular technological system or standard

- Does the firm want to be a monopolist in a (maybe very) small market, or a competitor in a larger market?

Customer decision

Customer decision:

– Consider benefits of competing technologies
  - Technological utility
  - Installed base of users
  - Availability of complementary goods and services

– What is going to be the future network size for the competing technologies?
  - Form expectations
  - If all or at least most customers form the same expectations, expectations will become a “self-fulfilling prophecy”
  - If consumers expect a seller to be dominant, they will be willing to pay more for the firm’s product

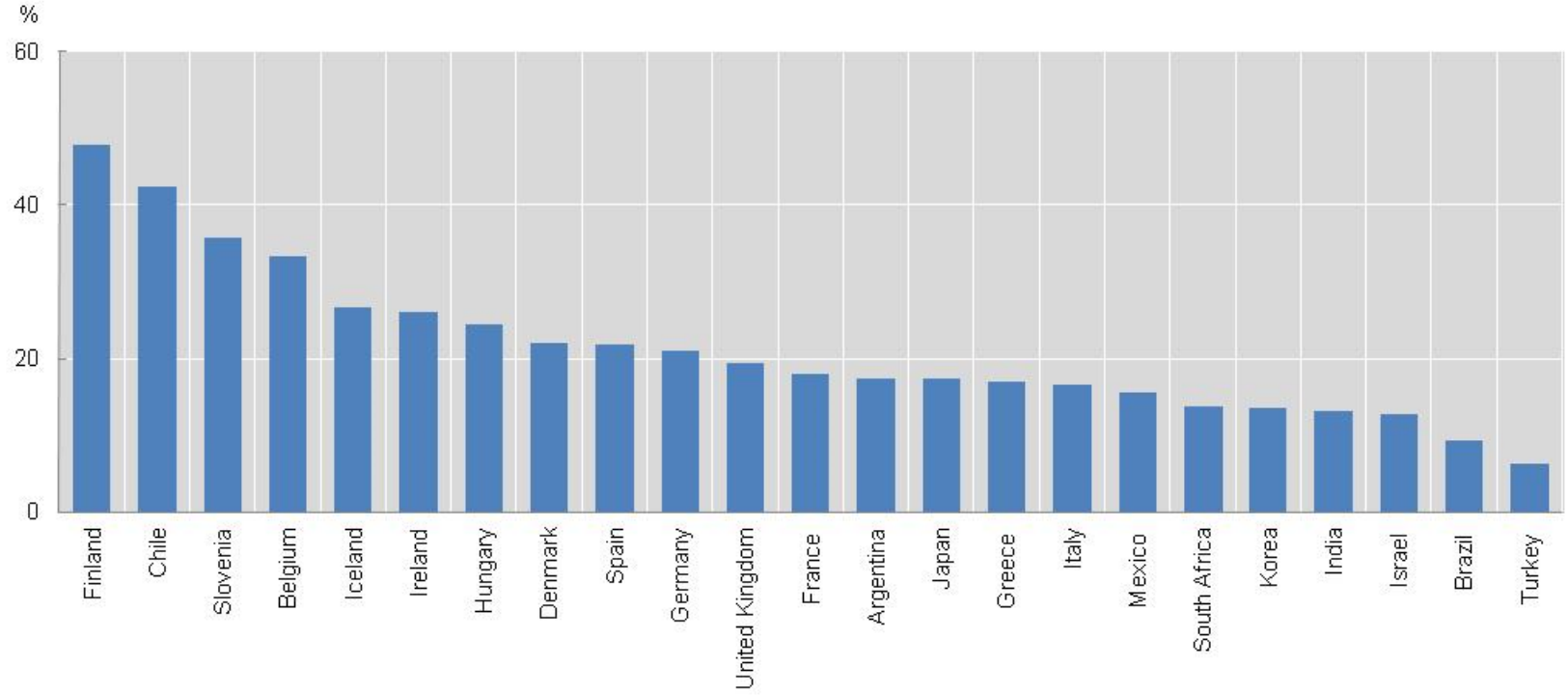
POLICY ISSUES

Favouring entrepreneurship

- Train people to be entrepreneurs
- Provide incentive to business R&D
- Lower barriers to entrepreneurship
- Balance tax instrument not to discourage entrepreneurship

TRAIN PEOPLE TO BECOME ENTREPRENEURS

Percentage of the population 18 to 64 years old who received any type of training in starting a business, during or after school, 2008



Entrepreneurship education is critical for raising awareness about starting and growing a business and providing the skills, attitudes and behaviours to do so.

Source: Bosma et al. (2009), *Global Entrepreneurship Monitor: 2008 Executive Report*.

Incentives to business R&D

- **Government direct R&D funding :**
  - grants / subsidies,
  - loans and
  - procurement.

  * Direct R&D grants/subsidies target specific projects with high potential social returns
  * Affect more long-term research.

- **Government indirect R&D funding :**
  - tax incentives such as R&D tax credits,
  - R&D allowances,
  - reductions in R&D workers' wage taxes and social security contributions,

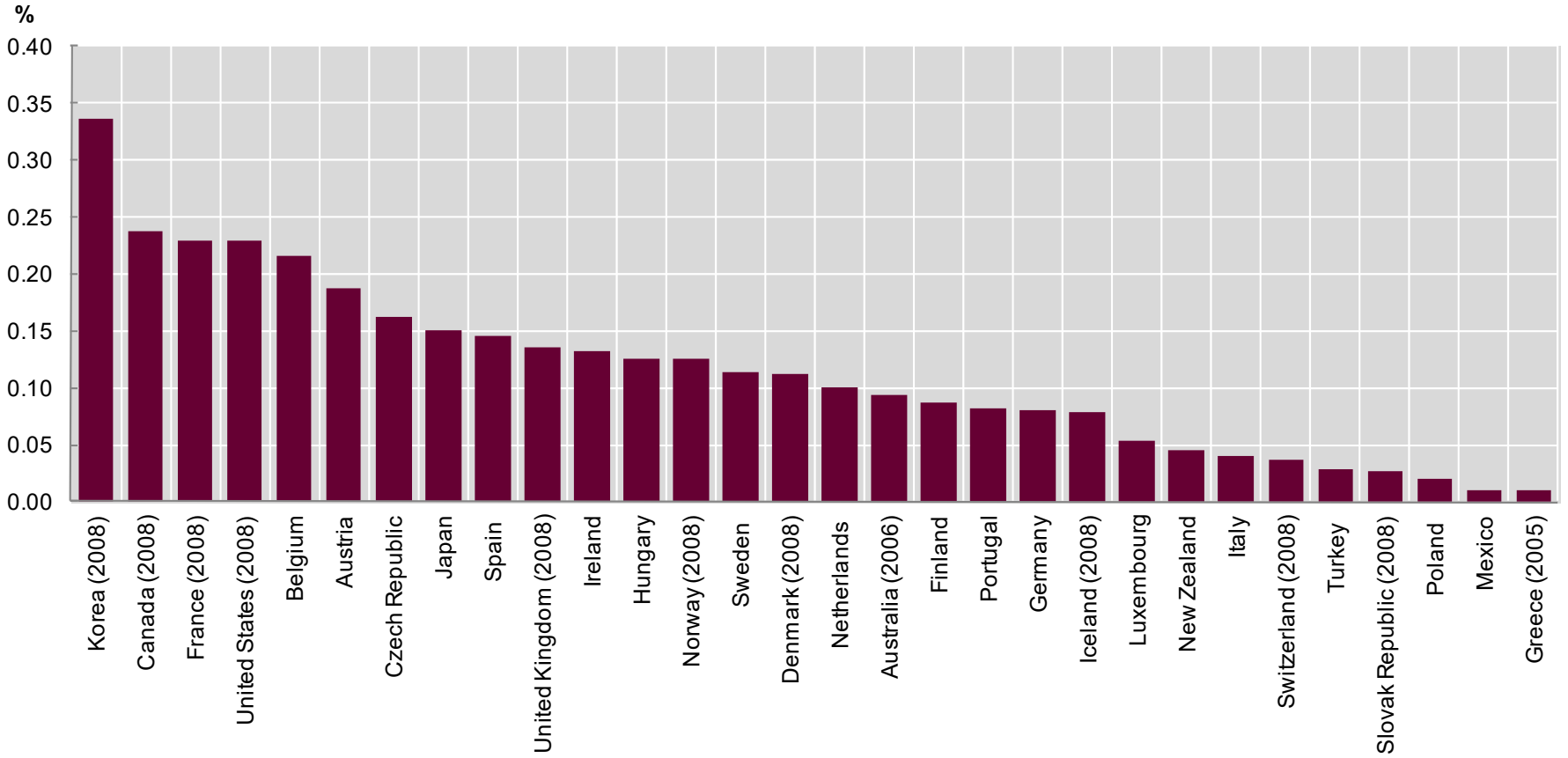
  * Tax credits reduce the marginal cost of R&D activities and allow private firms to choose which projects to fund.

  ***** encourage short-term applied research

- Countries differ in their use of direct and indirect support : The United States (through competitive R&D contracts) and Spain rely more on direct support, while Canada and Japan mostly use indirect support to foster industrial R&D.

PROVIDE INCENTIVES TO BUSINESS R&D

Total government support (direct + indirect) to business R&D, % GDP



Source: OECD (2010), *Measuring Innovation: A New Perspective*, OECD, Paris based on NESTI 2009 R&D tax incentives questionnaire.

Lower barriers to entrepreneurship

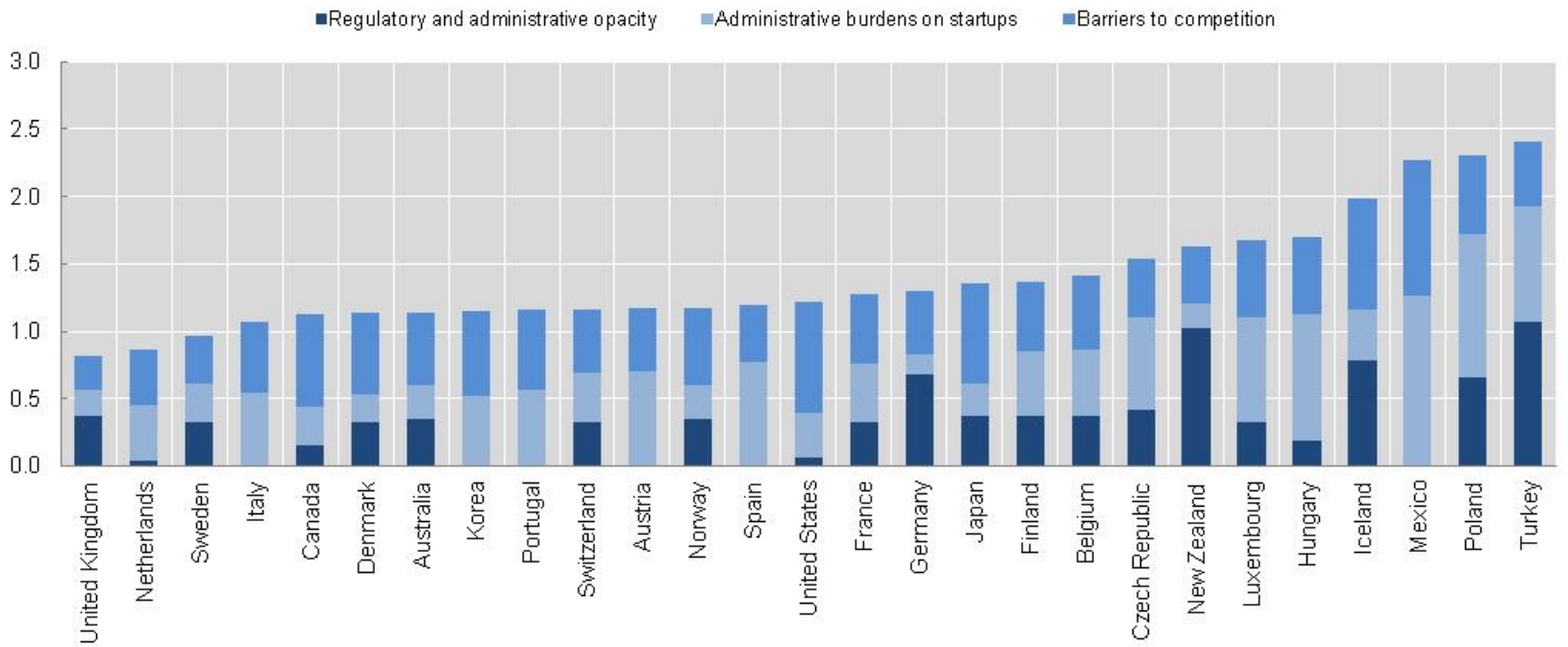
- ***A policy environment that fosters the start-up and growth of new firms is essential for innovation to flourish.***

- Barriers to competition : legal barriers, antitrust exemptions, barriers in network sectors and in retail and professional services;
- regulatory and administrative opacity : licences, permits, simplicity of procedures;
- administrative burdens for creating new firms.

LOWER BARRIERS TO ENTREPRENEURSHIP

Barriers to entrepreneurship, 2008

Scale from 0 to 6 from least to most restrictive



A high quality regulatory framework is important to allow businesses to enter the market and grow. Product Market Regulation Indicators are quantitative indicators derived form qualitative information on laws and regulations that may affect competition.

Source: OECD (2010), *Measuring Innovation: A New Perspective*, Paris, based on OECD Product Market Regulation Database.

Tax and entrepreneurship

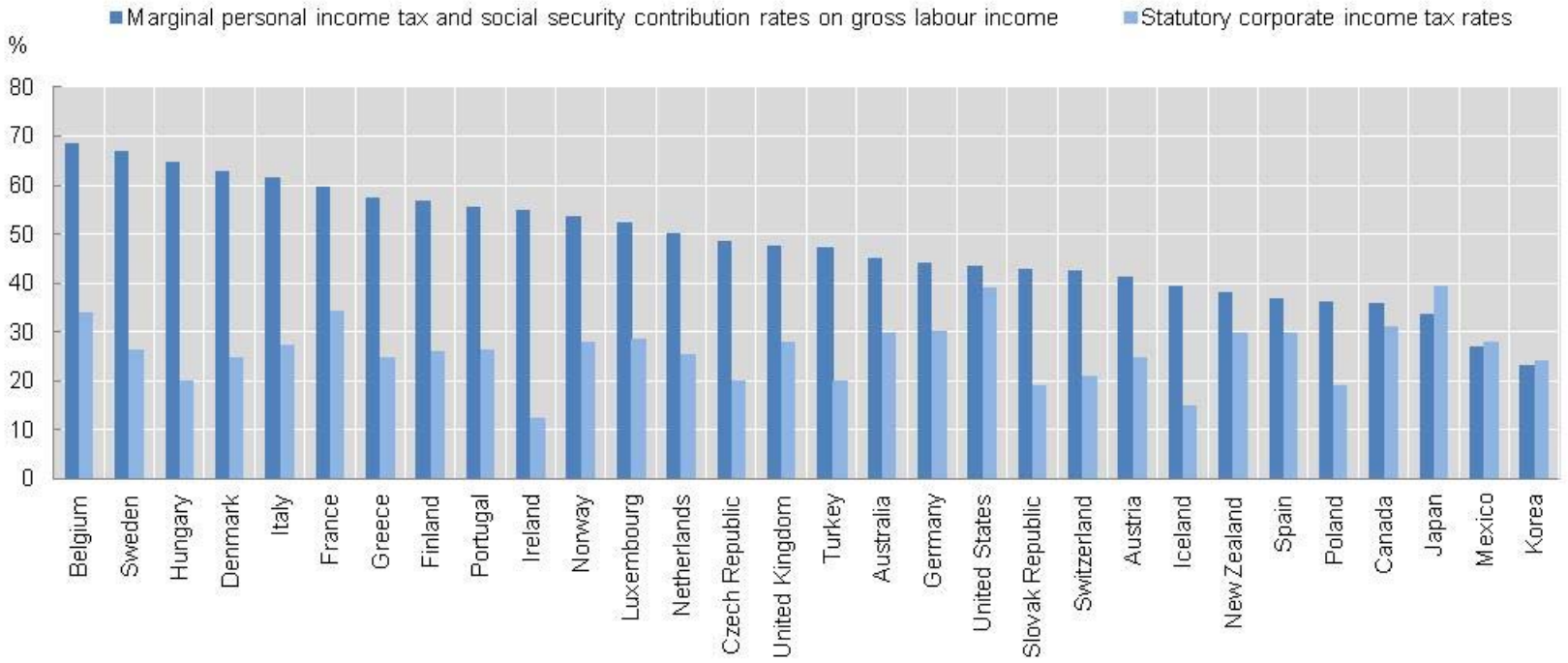
- Decisions to start a business are affected by tax policy
- general taxes : personal income, corporate and capital gain tax rates, social security contributions
- targeted tax policies : tax incentives targeted to start-ups, young firms and SMEs.

- The *marginal tax rate covers employees' and employers'* social security contributions and personal income tax.
- The *corporate income tax rate is the statutory* tax rate applicable to incorporated businesses.

- OECD (2012) analysis finds that reducing top marginal personal income tax rates raises productivity in industries with potentially high rates of enterprise creation.

BALANCE TAX INSTRUMENTS NOT TO DISCOURAGE ENTREPRENEURSHIP

Taxation on personal income and corporate income, 2009



Individuals' decisions to start a business are affected by taxes and tax policy.

Source: OECD (2010), *Taxing Wages 2008-2009: 2009 Edition*, Paris.

Competition policy

- How does competition policy deal with intellectual property rights - standards – interoperability ?
- Essential patents can be ab-(mis-)used ➔ Fight against strategic use of patents that confer market power to their holders

Competition policy

The problem : Patent Hold-up, based in the lock-in created by the costs of reengineering or switching away from an established standard

A patentee may manipulate SSOs (Standard Setting Organisations) to create hold-ups

- it may not disclose its patents to the SSO until after a patent-implicating standard has been adopted.
- it may agree to ambiguous licensing terms during the standard's creation, and later reveal, under the threat of suit, that their idea of reasonable terms is far more expensive than what the SSOs expected.