BS2243 – Lecture 10
Research and development

Spring 2012

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Importance of R&D and innovation – I

- Initial view about economic growth
  - Growth is driven by investment and capital (Harrod and Domar)

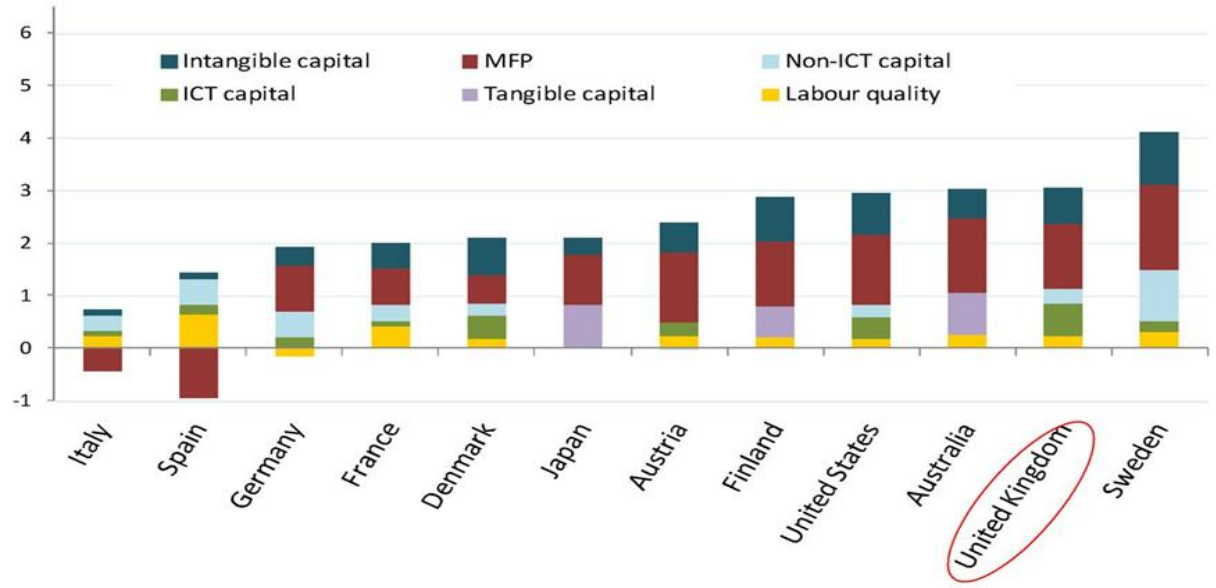
- Solow growth model
  - Growth is largely driven by technology
  - Since returns to capital is higher in developing countries than in developed countries, over time there will be convergence between the per capita GDP level of these two types of countries

- More recent view
  - Evidence suggests that the convergence has not taken place over the decades
  - In part, this is on account of divergence in technological progress between developed and developing countries

Importance of R&D and innovation – II

2. Innovation is key to growth...

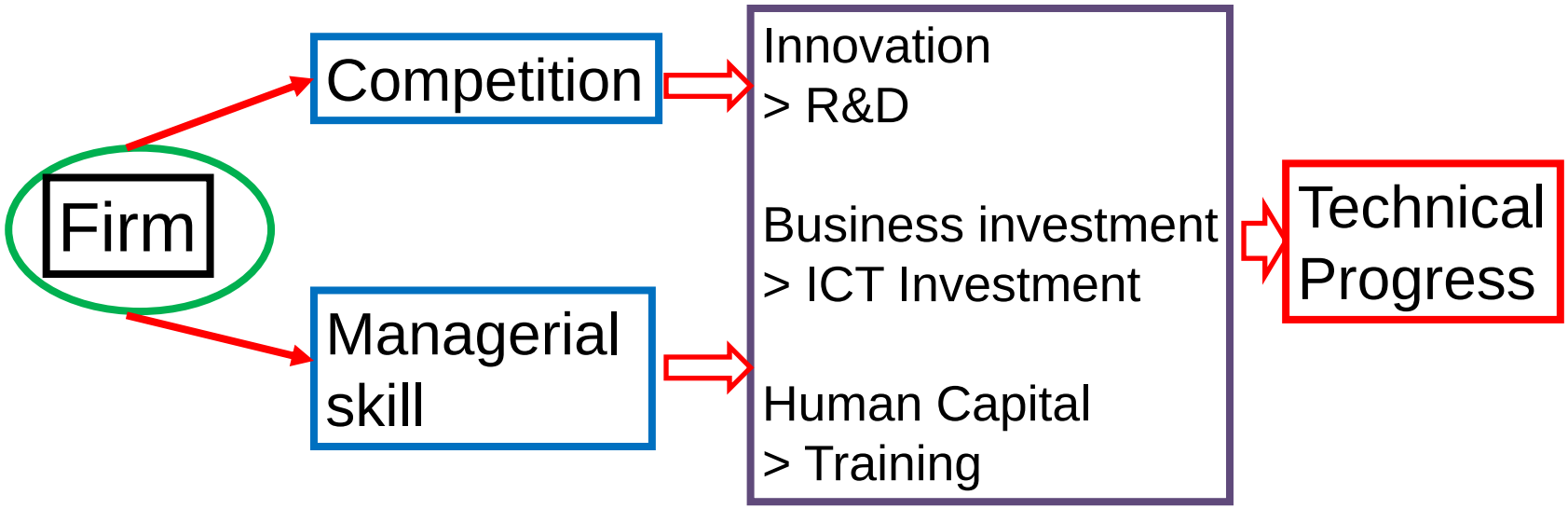
Contributions to labour productivity growth, 1995-2006, in %



** Investment in intangibles and multi-factor productivity growth account for between two-thirds and three-quarters of labour productivity growth.*

Source: OECD

Technical progress in firms



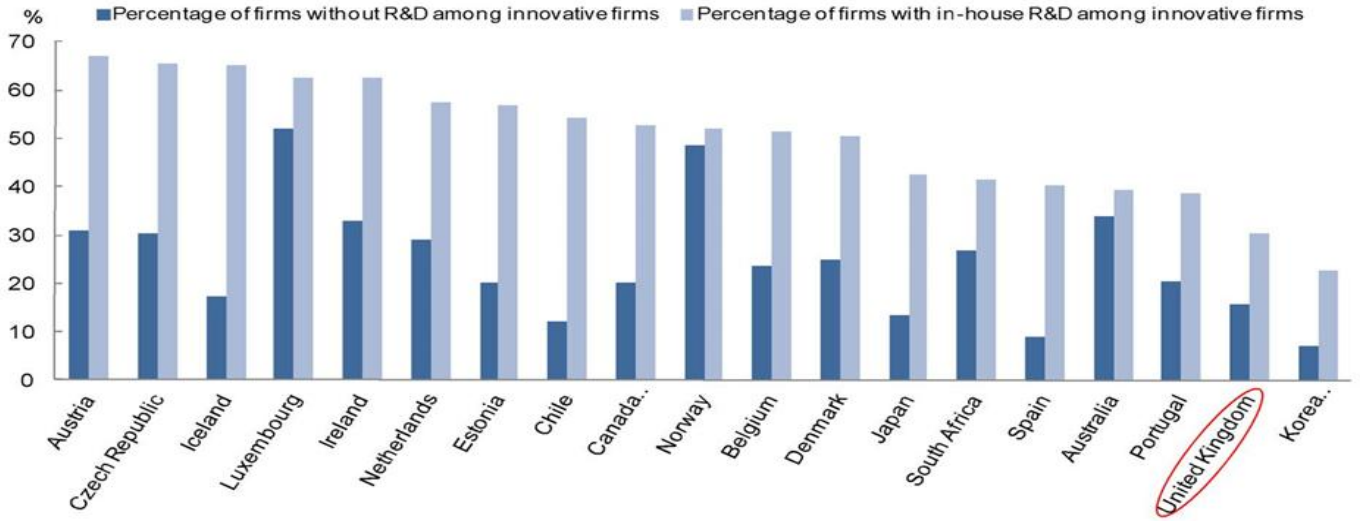
Source: Bhaumik, S.K. (2011). Productivity and the Economic Cycle. BIS Economic Paper No. 12, UK Department of Business Innovation and Skills.

R&D and innovation – data – I

The What: Innovation is not only about R&D …

New to market product innovators with and without R&D, 2004-06 (or latest)

As a percentage of innovators

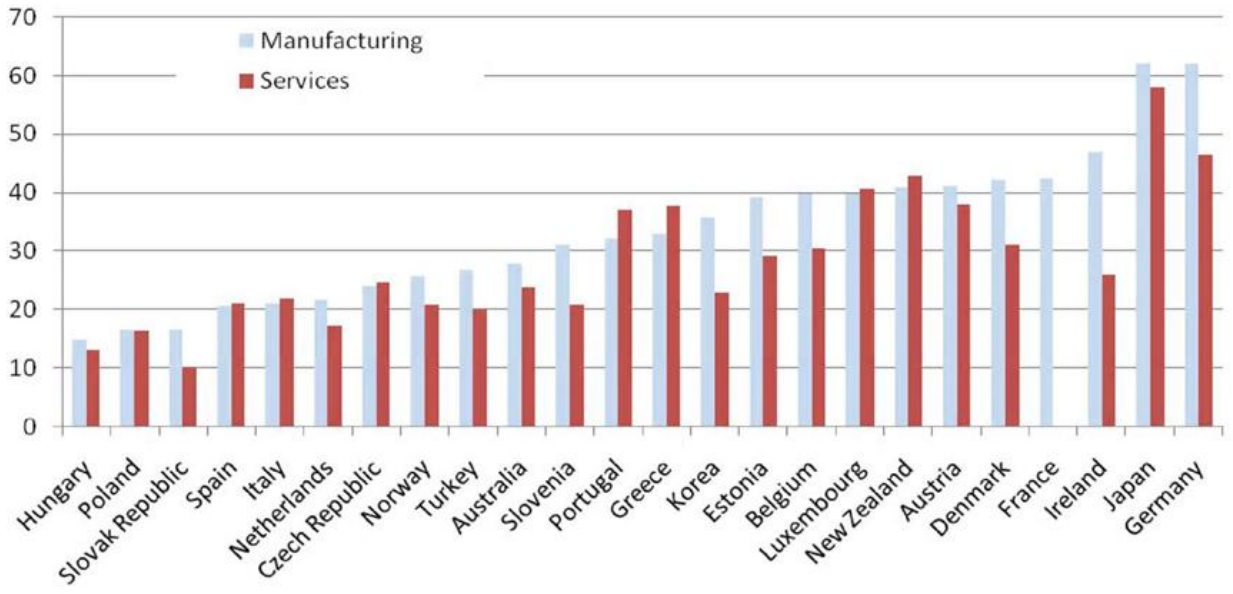


Source: OECD

R&D and innovation – data – II

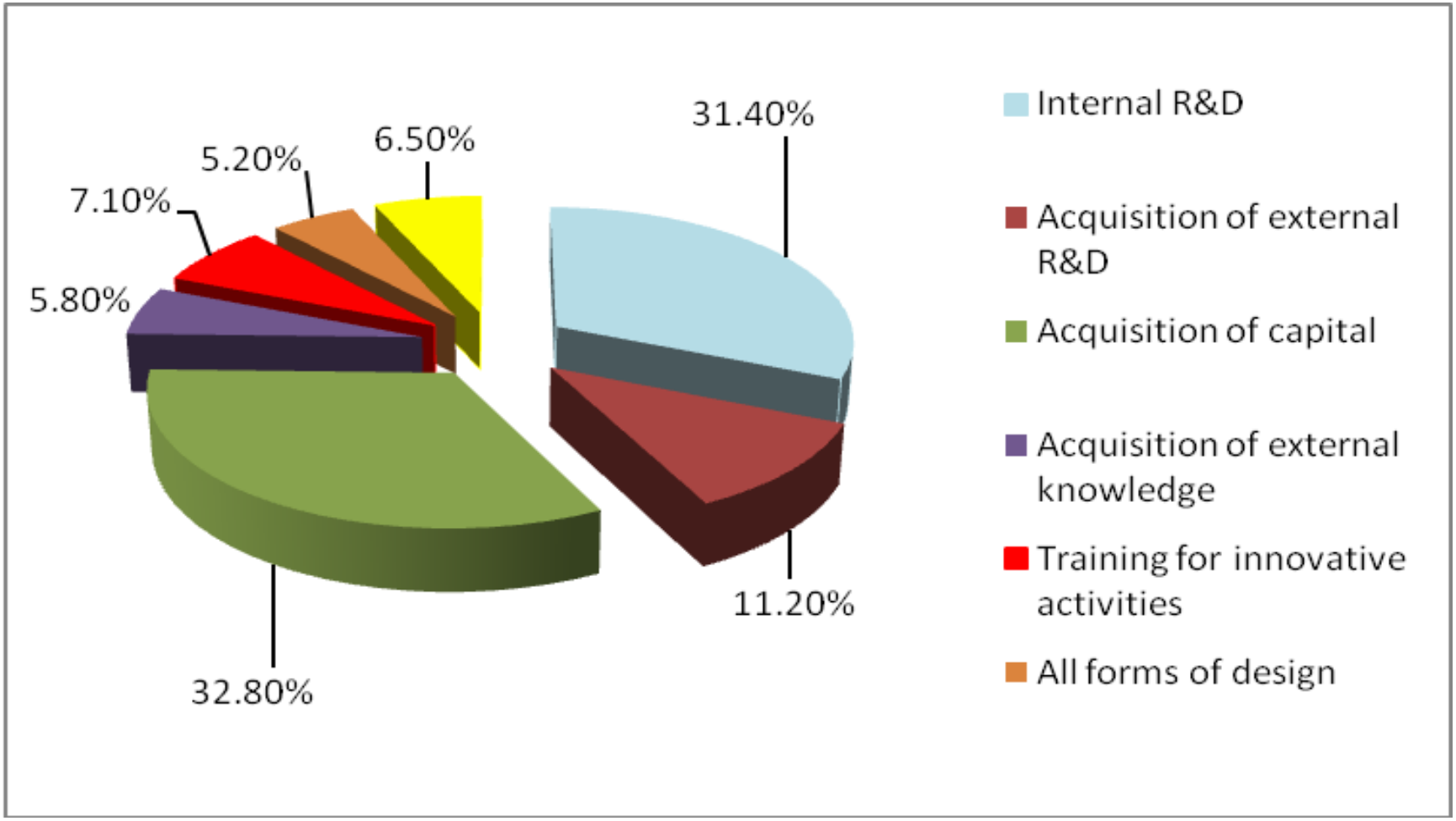
… and technology is only one approach to value creation

Non-technological innovators by sector, as a percentage of all firms, 2004-2006



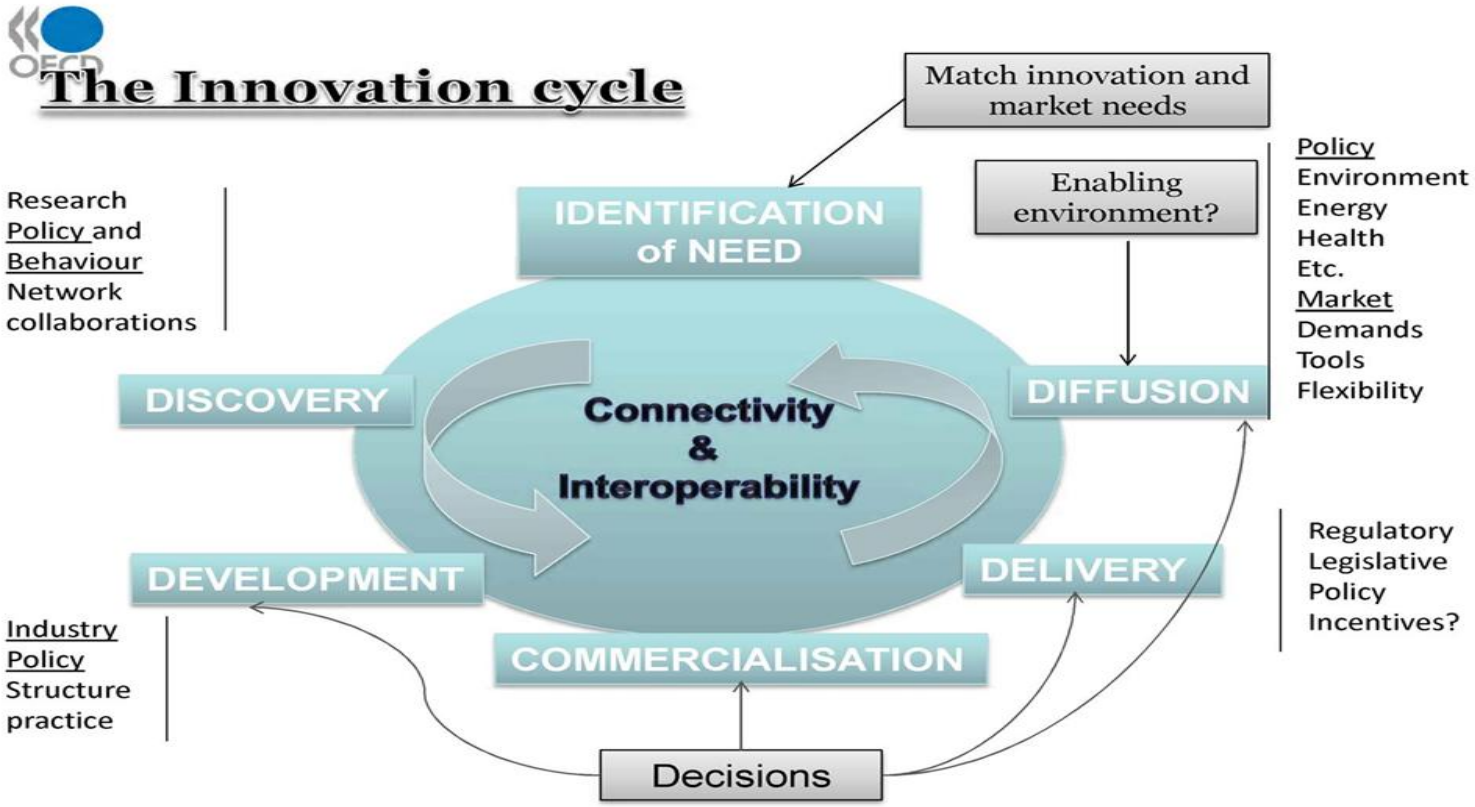
Source: OECD, based on CIS and national sources.

Innovation across sectors – UK



Source: UK Innovation Survey 2009: Science and Innovation Analysis (Figure 2.6)

R&D and innovation – inter-connectivity



Source: OECD

A world without patents

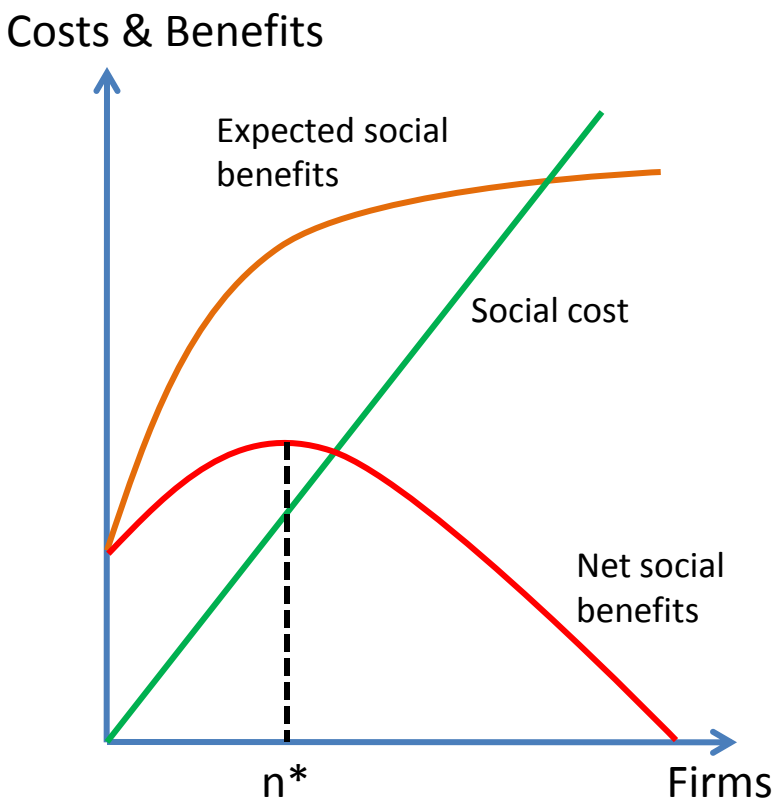
Firms in Bertand competition Cost of innovation = 1 Cost of imitation = 0		Company B	
		Innovate	Imitate
Company A	Innovate	(-1, -1)	(-1, 0)
	Imitate	(0, -1)	(0, 0)

Firms collude to maximise joint profit Cost of innovation = 1 Cost of imitation = 0		Company B	
		Innovate	Imitate
Company A	Innovate	(2, 2)	(2, 3)
	Imitate	(3, 2)	(1, 1)

Patents – some questions

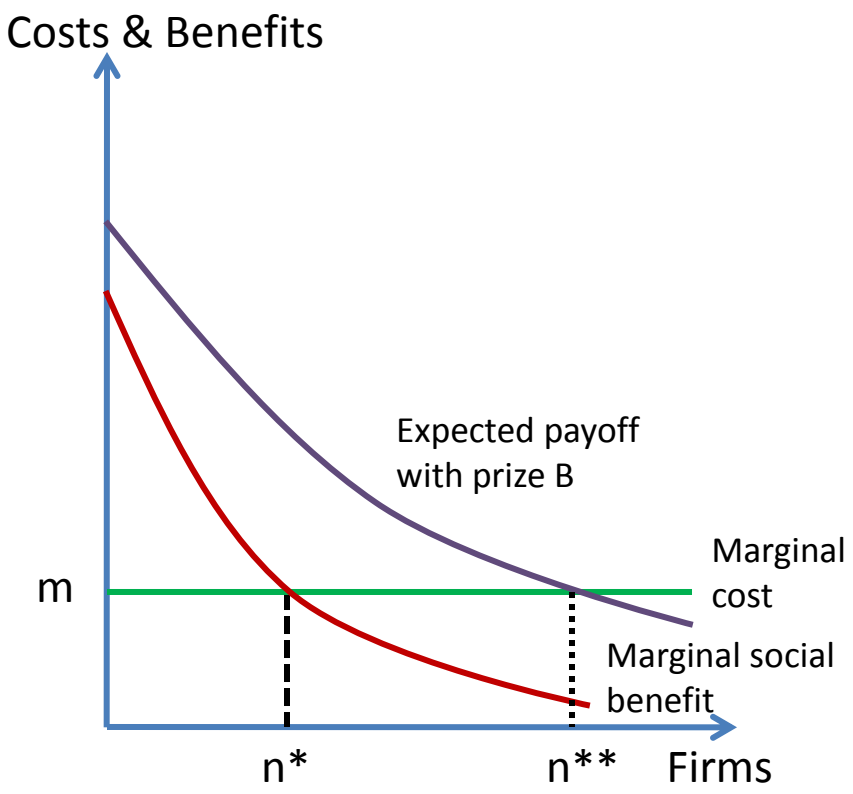
- If there were no patents or other government incentives, would there be too little R&D?
- If there is too little research, should the patent system be used to encourage research rather than other incentives such as prizes, research contracts and joint ventures?
- How long should patent protection last to obtain the best trade off between incentives to invest and harmful effects of monopoly?
- Are monopoly profits higher if a patent holder produces the invention or licences it to others for production?
- How does the structure of the product market affect the incentives to conduct research and the timing of innovations?

Patents – optimal research



- Assumptions:
  - *n* firms in the industry
  - each undertakes one project with MC = AC = 1
  - probability of success of at least one project increases with the number of firms
  - if successful, the new product will generate value for the society of magnitude B > 1
- Optimal number of firms:
  - Expected social benefit does not rise fast after a certain number of firms enter the industry
  - Social cost is *n*
  - Net social benefit is maximised for *n** number of firms

Alternatives to patent



- Government contract
- Joint ventures
  - Benefits: reduces duplication of research; gains from exchange of ideas
  - Cost: likelihood of tacit understanding about products and prices, i.e., collusion
- Prizes
  - Winner takes all
  - Expected payoff to each firm increases
  - In equilibrium, there are more firms in the industry
  - The likelihood of success is higher, but not commensurate with the cost

Strategic decision – using vs. licensing new technology

MONOPOLY

- Demand: P = 100 – Q
- Initial cost:

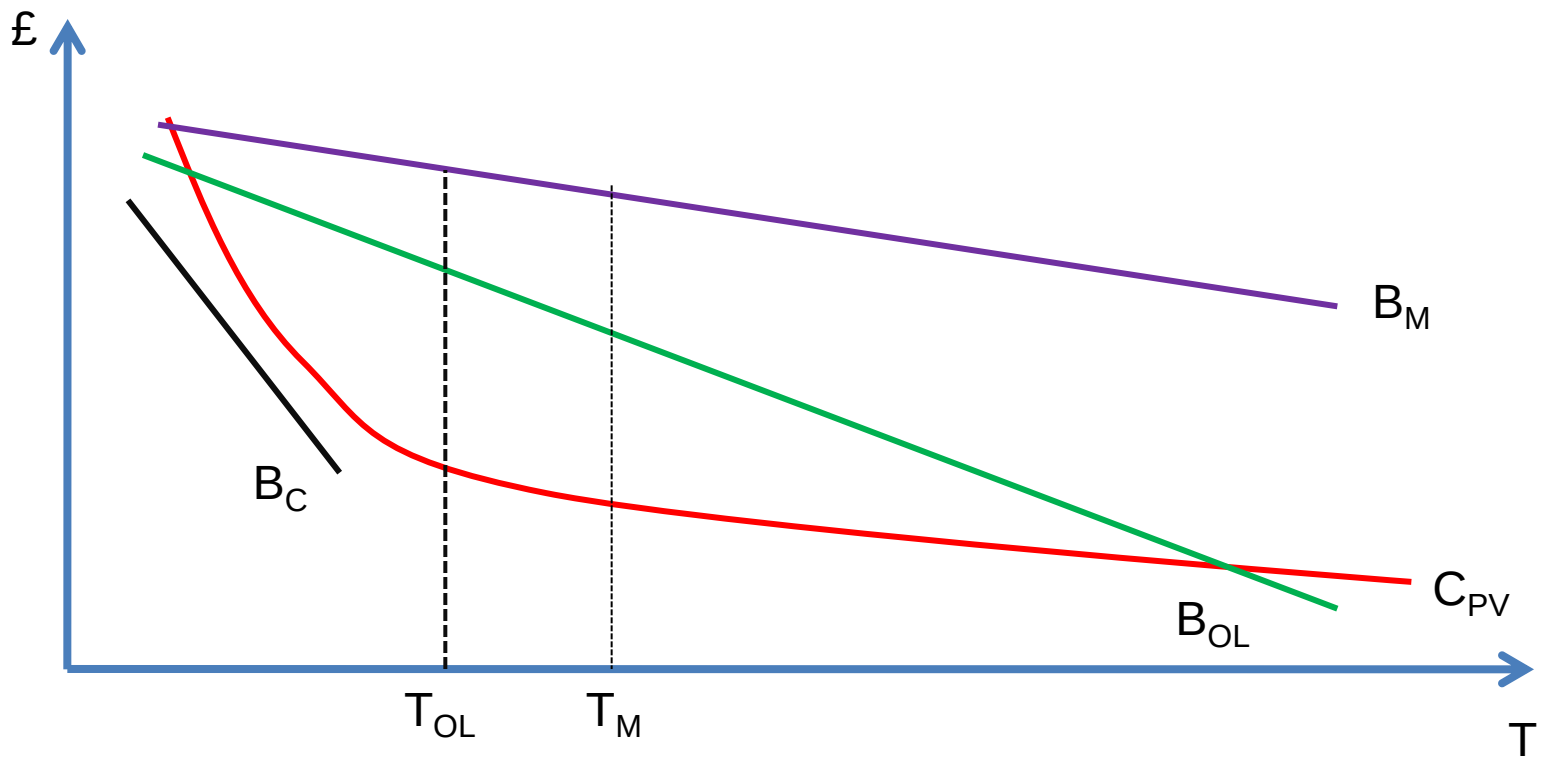
  $AC_{M1} = MC_{M1} = £30$
  - $Q_{M1} = 35$; $P_{M1} = £65$
  - Profit = £1225
- Innovation reduces cost:

  $AC_{M2} = MC_{M2} = £20$
  - $Q_{M2} = 40$; $P_{M2} = £60$
  - Profit = £1600
- Gain to monopolist on account of profit = £375

PERFECT COMPETITION

- In competition, profit is always zero in the long run, and hence there is no gain from innovation
- Competitive firm licenses the product for £10:
  - Production cost with licensed technology: $MC_C = AC_C = 20$
  - Overall cost including royalty for technology = 30
  - Royalty payments = 70 x 10 = 700

Market structure and innovation



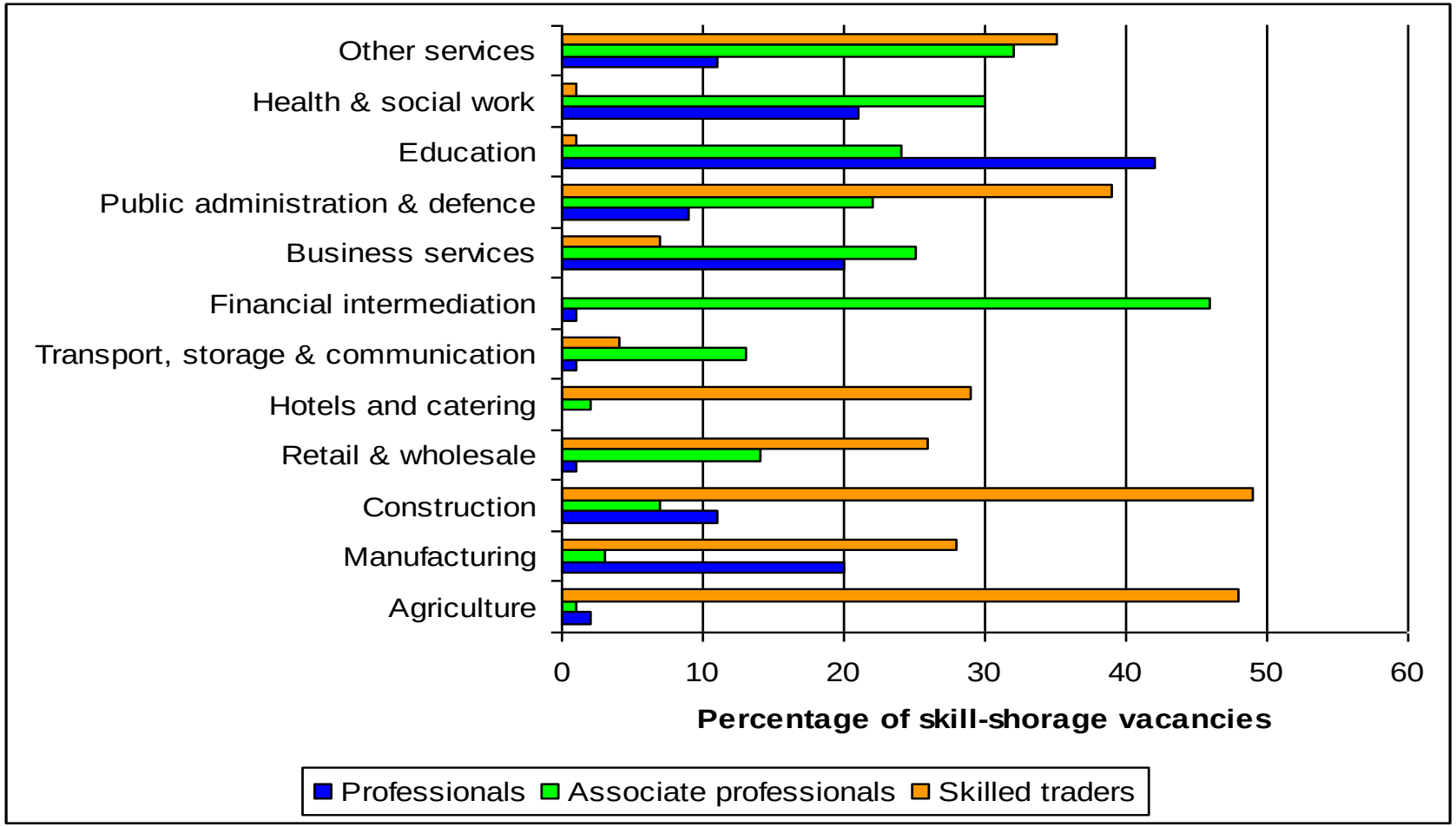
- Innovation is likely to start earlier in oligopoly than in monopoly
- The cost structure would determine how many markets would witness innovation

Firm size and innovation

- Advantages of large firms
  - Greater resources
  - Economies of scale in production reduces average cost of innovation
  - There are economies of scope across many operations
  - Risk spread across many projects

- Disadvantages of large firms
  - Security breeds complacency
  - Strategic inertia
  - Unionisation of labourers

Complementary factors – skills



Source: *Skills for Jobs: Today and Tomorrow*, Volume 1, UKCES (2010), Table 3