

The presence of externalities and increasing returns to 'knowledge' make it possible for a large and rich economy to grow indefinitely at a faster pace than a small and poor economy. They also make it possible for an economy to grow at an increasing pace as it becomes larger and richer. The opportunities that exist in rich countries with a large and highly skilled labor force working with advanced technologies are not so widely or readily available in poorer countries. In such countries, a much smaller proportion of the work force has the skills necessary to take advantage of new technologies.

Product improvement occurs in a slew of sectors. At a given point in time, each sector can either have a quality leader who serves the entire market, or it can have an arbitrary number of oligopolists competing on prices. Product quality improvements depend on innovations and the R&D intensity. By improving a good, an entrepreneur gains a competitive edge in the market and captures a segment of the market. This temporary monopoly ensures that the innovator can reap the rents and offset the costs for R&D. Furthermore, progress is not uniform across sectors due to the random nature of innovations.

The innovation process can be characterized by the externalities it generates. Grossman and Helpman⁶² (GH, henceforth) identify two effects: (a) a consumer-surplus effect, which describes the positive externality bestowed upon consumers from successful innovations and advanced product quality; and (b) a business-stealing effect, which captures the negative externality imposed on a rival firm when an innovator reduces or eliminates the producer surplus of the rival firm it displaces. Let me illustrate the dynamics briefly.

IBM brought to market micro personal computers (PCs) at substantial upfront cost in R&D. On account of its entrenched position in business computers and being the first mover in PCs, IBM made above normal profits. These profits soon attracted entry by imitators who simply did "reverse engineering" and came out with IBM-compatible hardware at lower prices. The new knowledge of producing PCs spills over in rest of the industry and other related industries. Lower unit costs come about on account of economies of scale in the new knowledge using industries. The PC market is an imperfectly competitive one where firms are making positive economic profits. IBM responds to the whittling away of its profits by speeding up R&D efforts and brings out an advanced second generation PC to maintain its "top dog" position. Its rivals in the imperfectly competitive market follow suit. The cycle repeats itself with greater force, as the intensity and speed of R&D activity increases each time. Innovations in such an industry are generated by the interplay of forces within the market itself.

⁶² Gene M. Grossman and Elhanan Helpman, 1991, *op. cit.*