6. R&D and First-Mover Advantage

First-mover advantages allow the established firms to restrict or prevent competition. One way to gain advantage in the markets for an established firm is to introduce innovative products or processes in its business before its potential rivals move in. An important aspect of "sunk" R&D costs is their commitment value. A firm that incurs large R&D expenses today signals that it will be around tomorrow. Once this commitment is recognized by one's potential rivals, it may have strategic effects. Rivals may interpret the R&D investment as bad news about the profitability of the market and may reduce their scale of entry or not enter at all.

A firm can gain and sustain competitive advantage by achieving lower costs relative to its rivals in the product market. By investing in R&D, the firm can introduce process innovation and remain ahead of the pack. When easy imitation of base technology, such as in pharmaceutical products, decreases the product life cycle, the market share that comes from being first is substantial. Thus, some firms will do R&D even in the absence of the patent regime, possibly to secure a technological lead and an innovator profile in the industry.

There are three important factors in Nordhaus' social welfare maximizing calculus of optimal patent life: (1) the responsiveness of demand to price changes[85]; (2) the "ease" or "difficulty" of achieving cost reducing innovations[86]; and (3) the gains from competitive imitation[87].

The three major conclusions from Nordhaus' model are as follows: First, the greater the responsiveness of demand to price reductions, the shorter the socially optimal patent life. As the demand responsiveness increases[88], the area of the welfare triangle, the area ABD in Figure 1, increases, making society less and less willing to postpone its capture. Second, the "easier" it is to achieve a given cost reduction[89], the shorter the socially

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[85] This measure is called the *demand price elasticity*. If a 10 percent decrease in price results in: (a) 10 percent increase in demand, then the elasticity is unity; (b) more than a 10 percent increase in demand, then demand is elastic; (c) less than a 10 percent increase, then it is inelastic.

[86] This depends on the shape or steepness of the invention possibility function (IPF).

[87] This depends on the curvature or sharpness of the IPF

[88] That is, as the demand price elasticity increases.

[89] That is, the steeper is the IPF, reflecting larger cost reductions.