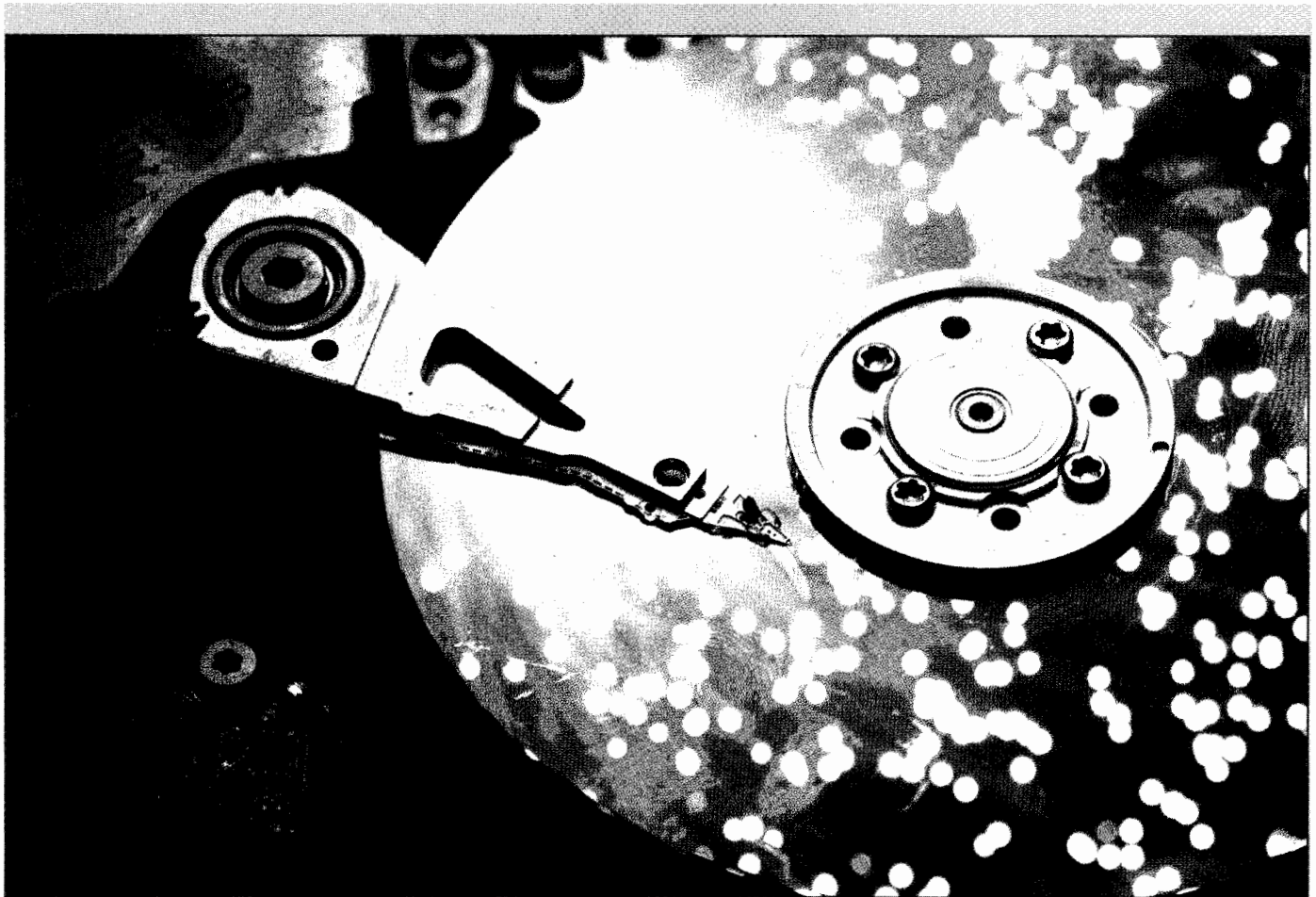


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Calculating the Spread of Technology

Some theories diagnose proliferation like a disease; others treat the causes behind the buildup

BY JURGEN BRAUER



The wheels of industry move in numerous ways after invention. (Photo credit: Shutterstock.)

Technology, we all know, improves productivity — at home and in the workplace — and makes for healthier, longer, and more convenient lives. So, exactly where does it spring from and how does it diffuse within and across economies?

Actually, economists still much debate the “where does it come from?” question.

But with regard to how technology spreads, once a new invention comes along, one view is borrowed from medicine.

The epidemic model: a type of multiplication

Technology spreads like a contagious disease, an epidemic.

A central source, the inventor, transmits knowledge. The inventor is in touch with, say, 100 people but the 100 people, in turn, are in touch with another 100 people each. That amounts to 10,000 people already and accounts for explosive growth in the spread or diffusion of a new technology.

Of course, since there are a limited number of people on earth, the growth must stop. At some point, people who are unaware of the new technology are harder to find (everyone assumes that everyone already knows) and so, after an explosive phase of knowledge diffusion, a phase of slow growth follows, as the market is saturated with general knowledge about the invention.

Relatively simple technology will spread faster than more complex technology; likewise, technology will spread faster where there is greater density of population so that "infection rates" take place faster. Technology also will spread faster in environments that consist of fairly homogenous populations in terms of background knowledge and experience; inversely, technology will spread less fast when it has to jump from one community to another. For example, certain technologies will spread very fast among "techie" in the computer world but more slowly, maybe much more slowly, among "nontechies."

The epidemic model is useful but has its limitations. It assumes that people are willing and able to receive information and then simply adopt the technology. In practice, people often need to be persuaded to do so because adopting new technology can be costly and needs to be set against benefits to be reaped.

The probit model: a look at rationales

Models that focus on the adoption decision of an individual firm or person are called probit models.

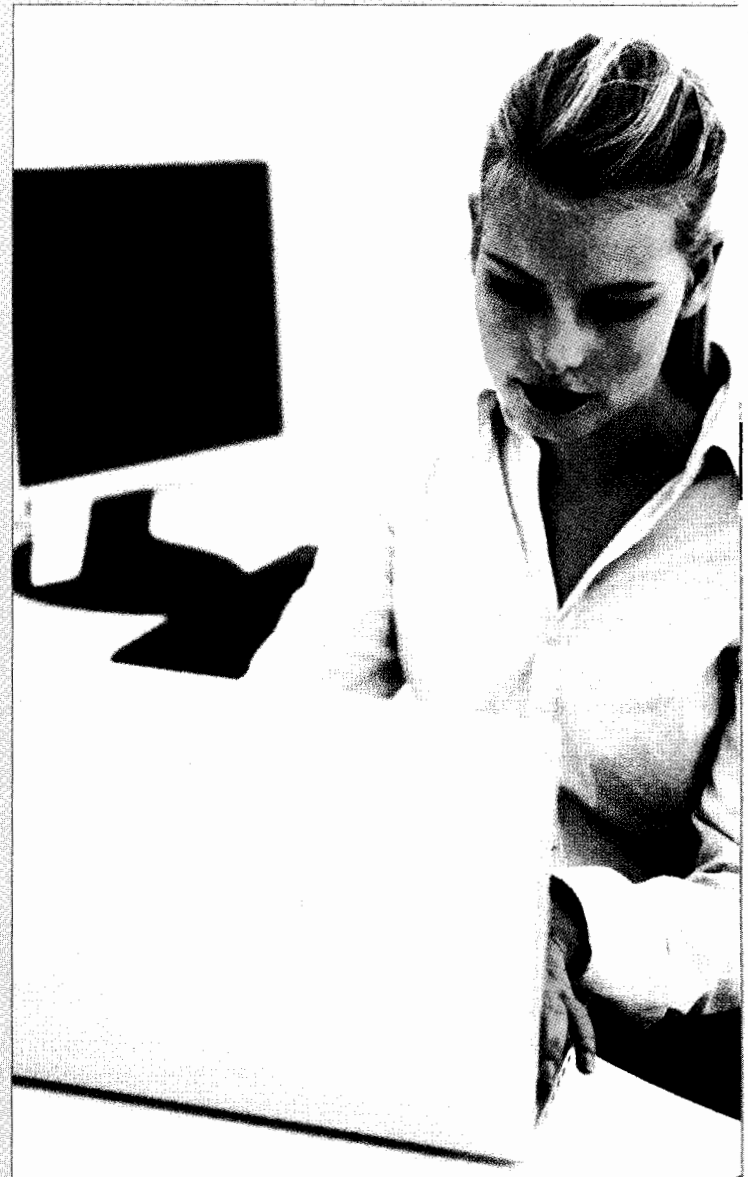
Probit refers to the probability that a firm or person either adopts or does not adopt a given new technology, and probit models trace the determinants by which people arrive at a "no" or "yes" adoption decision as well as the speed with which people switch from one to the other.

Understanding the determinants of the decision is of obvious importance for government policy. If technology improves lives, then we will want to know how to mitigate the "no" determinants and, conversely, how to make the "yes" determinants obtain more weight in the decision-making process. Larger firms, for instance, can spread the cost of a new technology over larger production runs or over larger numbers of customers to which they supply services.

But in many contrary instances it also has been found that smaller firms adopt new technology more quickly because either they are more nimble in their decision-making or the new technology is the brainchild of an inventor who then starts up a new, and necessarily small, firm. For example, there were no big companies that wanted to deal with the newfangled personal computer technology of the 1980s.

Changing from one technology to another involves search, learning, and switching costs that may be considerable. Potential suppliers should be glad to ease those costs — but these potential suppliers also need to beware of inadvertently undercutting old technology from which they can still earn a revenue stream. Why push the envelope if there is still money to be made from business as usual?

Whereas epidemic models are good at telling us something about the cumulative spread of certain technology over time (the "when"), probit models are better at informing us about individual adoption decisions (the "who" and "why"). Neither model is very good at the "where," that is, the spread of technology across geographical space, either within or across countries. To understand this is an area of continuing research. ■



Computer-savvy people help expand technology's reach.
(Photo credit: Shutterstock.)



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