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What Determines the Diffusion of ICT at Firm Level?

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A Statistical Analysis of Households and Families in Ireland

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Growing empirical evidence indicates that Information and Communication Technologies (ICT) are strong determinants of productivity growth differentials as well as the ability of countries to benefit from globalisation. The impact of ICT investment on productivity and growth has been found to be greater at firm level than at industry and country levels. At the firm level, ICT use leads to improvements in product design, marketing, production, finance and the organisation of firms. Furthermore, it has been shown that ICT use increases the productivity of R&D activities and facilitates the creation of new goods and services.

Yet, empirical evidence indicates that the diffusion of ICT has been uneven across firms, industries, regions and countries. From the policy perspective, to the extent that a wide and fast diffusion of ICT is desirable, it is essential to understand what factors are likely to influence the diffusion of ICT. New technologies are adopted at different dates and speed depending on firm characteristics and the characteristics of the environment in which firms operate. To understand the diffusion of ICT as a new technology it is essential to uncover the factors that explain the variation in the rates of its adoption and use across firms, industries, regions and countries.

A recent published paper[†] analyses the patterns and determinants of ICT diffusion at the firm level in the manufacturing sector in Ireland using a novel data set including survey information on e-Commerce and ICT over the period 2001 to 2004. The analysis is based on a consideration of the relevant theoretical literature.

The early theoretical models of new technology diffusion known as *epidemic models* focus on the uncertainty related to new technologies and predict that the adoption of new technologies increases over time as the risk associated with adoption decreases due to learning effects across and within firms. Another

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group of theoretical models focus on the link between different adoption dates and differences in returns to the adoption of new technologies. *Rank* (or *probit*) *models* focus on the impact of firms characteristics on gross returns from adopting new technologies. Consequently, firms with high returns from using the new technology will be early adopters while firms with low returns will be late adopters. *Stock models* assume that the benefit to the marginal adopter from acquiring a new technology decreases with the number of previous adopters. Thus, for any cost of acquiring the new technology, adoption will not be profitable beyond a certain number of adopters. *Order models* assume that the return to a firm from adopting a new technology depends upon its position in the order of adoption. Early adopters achieve a greater return than late adopters. This implies that the firm's decision to adopt a new technology takes into account how waiting will affect its profits. The theoretical literature also distinguishes between the number of firms using the new technology (*inter-firm diffusion*) and the intensity of using the new technology by individual firms (*intra-firm diffusion*).

The analysis in the paper relates indicators of *inter-firm ICT adoption* (the usage of websites and online orders) and indicators of *intra-firm ICT use* (the share of employees using computers and the share of turnover due to online transactions) to characteristics of firms and features of the environment in which firms operate as suggested by the existing theoretical and empirical literature on new technology adoption. The research results suggest that firms that are larger, younger, fast growing, skill-intensive, export-intensive and firms located in the Dublin region have been relatively more successful in adopting and using ICT. The article also establishes that the probability of adopting and using ICT increased with the proximity to earlier ICT adopters in the same industry and region.

The determinants of inter- and intra-firm adoption of ICT were broadly similar with the exception of the effect of firm size and foreign ownership. Larger firms were more likely to be early adopters than small firms, but small firms used ICT more intensively than medium-sized firms. While the propensity to adopt ICT was not significantly different in foreign-owned firms in comparison to domestic firms, foreign-owned firms used ICT more intensively than domestic firms. With respect to inter-firm adoption of ICT, the research results indicate that the propensity to have a website was higher for larger, younger, fast-growing skill-intensive and export-intensive firms.

[†]Stefanie Haller and Iulia Siedschlag. 2011. Determinants of ICT adoption: Evidence from firm-level data, *Applied Economics*, 43:26, 3775-3788.