

Appendix E: caveats

In this Appendix we discuss in some length the caveats that our study comes with:

Our paper has four main caveats that all are due to binding data restrictions. (i) *Measurement of workplace reorganization*: we only observe whether a firm has conducted a workplace reorganization and do not know anything about the degree of radicalness of the reorganization. There might hence be differences even within the different form of workplace reorganization that we do not properly account for. (ii) *Generalizability*: Our analysis is concerned with the German business-related services sector. This sector differs markedly from other sectors, for example with respect to ICT use, an issue that is highlighted by Table A below.¹ We therefore believe that our results cannot directly be carried over to other sectors since, for instance to manufacturing industries which are characterized by much more heterogeneity regarding e.g. their investment strategies than firms from the business-related services sector. By the same token we believe that our

¹The table is taken from (?), who use German data based on a representative survey of the year 2000 which did not contain any information on workplace reorganization. In that survey, the business-related services comprise the industries: computer and telecommunication services, technical services and other business services. As the table shows, business-related services industries according to this definition are characterized by a relatively intensive use of ICT compared to some other industries. The heterogeneity with respect to ICT as a share of total investment is much bigger across the industries of the manufacturing sector.

results are generalizable to the business-related services sectors of other OECD countries. (iii) *Cost variables*: We do not directly observe reorganization cost and use proxy variables instead. These proxy variables definitely do not cover all aspects of reorganization cost. They do, however, a good job in identifying the estimation equations which in turn justifies our variable selection. (iv) *Unobserved heterogeneity*: We do know, at least since the lesson taught by (?), that taking unobserved heterogeneity into account can markedly affect productivity estimation results. Our data is cross-sectional only so that we cannot model unobserved heterogeneity by using fixed effects estimation. The heterogeneity of the business-related services sector is, however, as already mentioned, less dramatic than in manufacturing industries (? 2002, Ch. 2) so that this problem might be of minor importance in this study.

A last and at least potential drawback of our paper that is unrelated to data and measurement issues is that we assume a Cobb–Douglas production technology which is along the lines of much of the literature and which is particularly often applied in the literature on the productivity effects of R&D as well as on the productivity effects of ICT, as for example by Brynjolfsson and Hitt (1995, 1996). Using a Cobb–Douglas specification implies an elasticity of substitution of unity between the input factors by construction and does not take account of the possibility that organizational change might vary the elasticity of substitution between input factors, for example between labor and ICT. A popular alterna-

tive to the Cobb–Douglas production function is the Translog approach which is more flexible in terms of elasticities of substitution. In the estimation of such a Translog production function we would encounter the well-known problem of high collinearity between the input factors which, coupled with our relatively low number of observations, made our Translog estimates implausible e.g. with negative mean production elasticities so that we believe that our restricted Cobb–Douglas specification is more reliable than the Translog specification. ?), for example, apply both specifications, Cobb–Douglas and Translog, to a data set of 1185 U.S. firms. The estimated elasticities resulting from the Translog specification turn out to be comparable to those of the Cobb-Douglas specification (p. 192 of their paper).

With this caveats in mind, our main conclusions from the estimation results are the following: the estimation results emphasize that, in line with ?), ?) and ?), the enlargement of the discussion on the productivity effects of ICT by taking into account organizational change is crucial. Moreover, we find that further analyses on the productivity effects of workplace organization need to take into account the complementarity between workplace organization and input factors as well as the simultaneity between organizational change and productivity.

Table A: Descriptive Statistics of the ICT-investment as a share of total investment across industries

	Mean	Std. err.	Obs
consumer goods	0.1373	0.2194	131
chemical industry	0.1147	0.1521	75
other basic goods	0.0801	0.1274	141
mechanical engineering	0.1241	0.1339	153
electrical engineering	0.1622	0.1934	112
medical, precision and optical instruments	0.1546	0.1709	113
motor manufacturing industry	0.1298	0.1465	112
wholesale trade	0.1385	0.1420	89
retail trade	0.1821	0.2256	92
transport and post	0.0973	0.1796	110
financial intermediation	0.2799	0.2630	79
computer and telecommunication services	0.3488	0.3000	112
technical service industries	0.2676	0.2488	111
other business services	0.1884	0.2273	94

Table A displays descriptive statistics based on a ZEW-survey in the year 2000. The data is described by ?).