ON THE RELATIONSHIP BETWEEN INNOVATION AND PERFORMANCE: A SENSITIVITY ANALYSIS

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SUMMARY

This study was aimed at investigating the sensitivity of the estimated relationship between innovativeness and firm performance. We compared the sensitivity of results with regards to different types of models, estimation methods, measures of firm performance, sub-samples of business sectors, types of innovations and indicators of innovative activities, different data sources and specifications of the innovation model. In addition we also compared results from cases where the performance variables are defined in level and growth rate terms.

We have in particular tried to acquire more detailed information on various key characteristics of firms. This includes information related to R&D, various innovation inputs and innovation indicators, human capital and other economic data variables at the individual firm level. In our view, the goal was satisfactorily achieved by augmenting information from a large innovation survey with firm level data from register data. The combined data is comprehensive and covers about 50\% of all service and manufacturing firms in Sweden in 1998 with 20 or more employees.

The novelty of our paper is in its being one of the first attempts to estimate a knowledge production function model using an extensive and representative sample of manufacturing as well as service firms, and using the same framework but accounting for the heterogeneity of the two industries. The main empirical results are as follows.

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First, in addition to having higher employment, innovative firms have a higher level of total sales, total value added, total profit before and after depreciation, total assets, total physical capital, human capital and a higher sales margin and return on assets than its non-innovative counterpart, when median value is considered. In per employee or intensity terms, a median innovative firm is also likely to be more productive and profitable and have a higher level of sales, more total assets and more physical capital than their non-innovative counterparts. Non-innovative firms, however, have somewhat higher employment growth rates than innovative firms.

Second, a notable similarity is found between service and manufacturing firms when the elasticity of value added per employee in levels and sales per employee with respect to innovation output is considered. This supports the view that services and goods are not much different and productivity or performance analysis raises similar difficulties for both sectors.

Third, innovation output defined as the share of total sales from new products and services has a larger impact on performance measured as the profit of the average manufacturing firm compared to the average service firm. The two types of firms might differ in their objectives and profit maximization behavior.

Fourth, we find evidence of a positive and significant correlation between knowledge capital and the productivity growth rate for manufacturing firms and a smaller but insignificant relationship for service firms. When productivity growth is replaced by employment growth, however, the relationship is reversed. The estimated impact of knowledge capital on employment growth is 0.13 for service firms and statistically significant. We do not observe any significant correlation between innovation and employment growth for the manufacturing firms.

Fifth, results from a comparison of different data sources but using an identical model specification indicate that survey data is a good approximation of “true” data represented by register data from annual reports when level regressions are considered. However, survey data is inferior to register data when the collection of data retrospectively is required.

Sixth, in distinguishing innovations on the basis on their degree of novelty, our results suggest that innovation new to the firm contributes more to the level and growth rate forms where performance is measured as sales and profit compared to innovation new to the market. However, among knowledge-intensive firms, radical innovations dominate and serve as the engine of growth in firm performance.

Seventh, in order to test the robustness of our basic version of the CDM model, which accounts for both simultaneity and selectivity bias, and also includes feedback from firm performance on innovation output, six alternative models were estimated. The results show that the feedback effect is not important, but ignoring both simultaneity and selectivity bias significantly reduces the estimated impact of innovation output on firm performance.

Finally, the last remark concerns the sensitivity analysis of CIS indicators versus Experimental Enlargement Survey indicators. We find that the information on product life cycle, rate of market growth, number of innovations per employee, number of employees hired as temporary labor, physical capital and human capital from the enlarged questionnaire contributes significantly to explaining the variations in productivity, innovation output and
innovation inputs. Among the regular CIS indicators, we find that export intensity is very informative, followed by cooperation on innovation, sources of knowledge, innovation strategy and factors hampering innovation activities.

KEY WORD: Knowledge capital, productivity, innovation, manufacturing, services, knowledge intensity, Community Innovation Survey.

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