Review for Economics: The Open-Access, Open-Assessment E-Journal

Modes of Innovation: Identification, Dynamics and Intra-industry Heterogeneity. An Analysis of Swiss Firm-level Data for the Period 1999 to 2008

This paper identifies, and explores the effects of, different innovation modes. A key research aim is to find out if modes are largely driven by firm specific factors, or if they are driven by sector characteristics. It improves on the extant literature by using highly disaggregated industry categories to examine within industry heterogeneity of modes: 4-digit sectors. Existing empirical evidence of this type is very scarce, and the paper, therefore, makes a very important contribution to that literature.

The paper further looks at the extent to which enterprises switch between innovation modes, the effects of innovation modes on a measure of enterprise performance. The data analysed is the Swiss version of the Community Innovation Survey. Four waves are combined into an unbalanced panel. The empirical methodologies chosen to arrive at the innovation modes are appropriate and established in the field (e.g. a combination of factor and cluster analyses to arrive at the modes).

The two key findings, both of which make an important contribution, are that i) there is a high degree of within industry differences in the application of innovation modes; and ii) that industry-specific factors drive performance.

My main observation on this paper is that it is rather ambitious in scope and dense with respect to the empirical results presented. It is pursuing more than one idea. There are three/four complex themes, each of which, in my view, could form a separate paper: on a) identifying innovation modes; b) are innovation modes driven by firm specific factors and as a result show heterogeneity within 4-digit industries; c) the dynamics in modes – do firms switch from one to another mode between surveys; d) effect on performance.

The more specific questions and comments that the paper raises for me are the following:

First, the inclusion of a clearer review of the extant literature on innovation modes, and, in particular, a deeper discussion on the activities / variables feeding into the modes could be helpful. The inclusion / exclusion of variables have a big influence on what modes emerge. Therefore, revealing the patterns in innovation modes across studies that have gone before can be seen as relevant to the reader to get a grasp of how the modes in this paper fit in with that literature.

Second, due to the exploratory nature of the methods in this paper the author is making a set of choices, in particular connected with the factor and cluster analyses, which impact on the results and the interpretation of results. These choices warrant more explanation. For example, the author chooses to retain five factors from the factor analysis. The last two out of these five factors explain less than 10% of variance in the data (see page 6 of the paper). Eigenvalues for the factors are not provided. The OECD Handbook on Constructing Composite Indicators suggests that “standard practice is to choose factors that: (i) have associated eigenvalues larger than one; (ii) contribute individually to the explanation of overall variance by more than 10%; and (iii) contribute cumulatively to the explanation of the overall variance by more than 60%.” (OECD 2008, page 89). It would also be useful to reveal the criteria of including a variable in the interpretation of a factor (more specifically is the cut-off point corr>0.4, and, if so, why?)

Third, the paper works with 153 4-digit industry sectors to examine if there is heterogeneity within the sectors. The minimum number of observations within each of those sectors is either eight or ten. Additionally to the inclusions of as many 4-digit sectors as possible, in my view it would have been useful to also look at the results based on industries in which there is larger number of observations only. The results would have fitted into Table 8 as an additional row over and above the cut-off of 8 or 10 enterprises.

Fourth, and regarding the regressions explaining performance, the data that is available to the author would potentially have allowed for testing for time lags between innovation modes and performance. Since many of the variables feeding into the modes are innovation inputs, this could be a relevant exercise. As the unit of analysis, at least in the versions of the CIS that I am familiar with, is the enterprise and not the company as a whole, it would also be useful to control for group belonging.

Finally, the author is explaining that some data is imputed data. More discussion and checks on the effects of these data manipulations and a sense of how much of the data is affected by this treatment would be useful.