MARKETS, COMPETITION, COOPERATION AND INNOVATION

ESRC Centre for Business Research, University of Cambridge Working Paper No.212

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September 2001

This Working Paper relates to the CBR Research Programme on Small and Medium-sized Enterprises

Abstract

The paper analyses the relationship between, on the one hand, markets, competition and cooperation, and on the other hand, firms' innovative behaviour. Drawing on ESRC Centre for Business Research survey results, the paper uses descriptive statistics and a qualitative response model to examine these relationships. Most firms face a relatively small number of major competitors. Non-price competition (or higher order qualitive competition) is ranked as more significant than price. We test formally for the relationships between competition, inter-firm cooperation and innovation. Our results indicate that a high level of *domestic* competition is positively correlated with the probability of innovating. In addition, inter-firm cooperation is found to be positively correlated with firms' probability of innovating. These results suggest that it is not just the *degree* of competition that is important but also the *nature* of the competitive process. Aspects of financial market pressure – such as a take-over bid – are found to be negatively correlated with the probability of innovating, especially in relation to product innovation.

JEL Codes: L14, L15, L23, O1, 032

Keywords: innovation; corporate performance; competitive environment; collaboration

Acknowledgements

We are grateful to Eric Wood for advice, particularly regarding the ESRC Centre for Business Research data on which he worked, and to David Canning, Ciaran Driver, John Spencer and Mary Trainor for helpful comments.

Further information about the ESRC Centre for Business Research can be found on the World Wide Web at the following address:

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1. Introduction

A comprehensive picture of British business, considering such factors as competitive structures, employment and skills, innovation, finance and growth is provided by a series of surveys carried out by the ESRC Centre for Business Research (CBR) at the University of Cambridge (and its predecessor the Small Business Research Centre)[1]. The first of these surveys was conducted in 1991 and was designed to provide a sample of 2000 independent businesses employing less than 500 workers, equally split between business services and manufacturing. The sampling frame used was the Dun and Bradstreet database (see Bullock, Duncan and Wood, 1996 for a discussion of the advantages and disadvantages of this database). Originally, 8050 firms were approached. Of these, 1880 were discarded as they were too large, subsidiaries, had ceased trading, or were otherwise outside the survey's scope. Of the 6170 firms that were surveyed, 2028 returned useable questionnaires, a response rate of 32.9 per cent. The results of this survey (SBRC, 1992) provided the first comprehensive analysis of the UK small and medium sized firm (SME) sector since Bolton (1971).

A second survey was conducted in 1993, using a short questionnaire focusing on a few key variables. A third survey was conducted in 1995. It is the results of this third survey, using a questionnaire similar in scale to the first survey, which forms the basis of most of the analysis in this paper. Continued monitoring of the respondents to the original survey enabled identification of firms that had failed or were failing. Of the original 2018 respondents, 436 firms were excluded because of failure or because they were now outside the survey's scope. Of the 1592 firms surveyed, 681 firms returned the full postal questionnaire, and 317 firms completed shorter questionnaires, a total response rate of 62.7 per cent.

In order to draw a comparative picture, the respondents' characteristics were analysed according to a variety of categories, as follows:

- Two sectors (manufacturing and business services)
- Four size groups based on 1990 employment (micro, 0-9 employees; small, 10-99 employees; medium, 100-199 employees; and larger, 200 employees)
- Three employment growth categories between 1990 and 1995 (stable/declining - zero or negative growth; medium growth - greater than zero but less than 35 per cent; fast growth - over 35 per cent)
- Two innovation categories (based on whether the firm innovated or not during the period 1992-95) [2]
- Two collaboration categories[3] (based on whether the firm entered into a collaborative arrangements during the period 1992-95).

2. The Competitive Environment

Firms operate in a range of competitive environments. At one extreme, firms may compete in atomistic markets, with a large number of customers and competitors, with competition driven by price and cost factors. At the other extreme firms may operate in monopolistic or monopsonistic markets with no effective competitors, or with only one customer. The evidence from the CBR survey indicates that, although firms operate in diverse markets, the norm is for rather segmented markets - with firms relying on a few main customers and facing a limited number of competitors.

As reported in Table 1, 33 per cent of firms relied on just one customer for 25 per cent or more of their sales. The most apparent contrast is by firm size - micro and small firms are more likely to depend on just a few customers for the bulk of their business. Additionally, innovating firms are less likely to be dependent on a single customer than are non-innovating firms; 31 per cent of innovating firms - compared with 38 per cent of non-innovating firms - depend on just one customer to provide 25 per cent or more of their sales. In general, though, most firms have just a few key customers - indicating the importance to these firms of fostering their relations with customer-firms.

Table 2 reports that nearly two thirds of firms have less than ten serious competitors.[4] The notion that firms are competing with a vast array of other enterprises gains little support from these data. Most firms are operating in segmented and niche markets.

Economic theory suggests that the degree of competition plays a complex role in firms' innovative behaviour. Nickell (1996), for example, tests for the effect of competition on productivity, pointing out that the general belief regarding the efficacy of competition exists 'despite the fact that it is not supported by any strong theoretical foundation or by a large corpus of hard empirical evidence in its favour' (p. 725). Nickell's paper provides evidence of increased competition having a significantly positive effect on corporate performance, and similar results are reported by Nickell *et al.* (1997). These findings are in line with 'Schumpeter Mark I', according to which the pattern of innovative activity is characterised by technological ease of entry into an industry and by the major role played by new firms challenging established firms and thus continuously disrupting the current way of production, organisation and distribution and eliminating the quasi-rents associated with previous innovations.[5] On the other hand, 'Schumpeter Mark II' stresses the importance of large established firms that can institutionalise the innovation process with the creation of R&D laboratories filled with researchers, technicians and engineers. According to this model we would expect to see more innovation where there were just a few firms benefiting from ex-post market power acquired by successful innovation, rather than a high degree of competition (Schumpeter, 1947). We examine these competing hypotheses about the relation between firm size and innovative activity in Sections 4 and 5 below.

Decreasing trade barriers and increased globalisation have contributed to the analysis of not just the *level* of competition but also the *source* of competition. The hypothesis that increasing imports and inward foreign direct investment (FDI) have positive effects on the competitive behaviour of domestic firms and negative effects on their profitability have been subject to considerable theoretical and empirical analysis. The empirical evidence suggests that no outcome is certain. Increased imports and/or inward FDI can have both positive and negative effects on domestic firms' competitiveness. On the one hand, positive effects may be generated by imposing 'market discipline' and through positive 'spillover' effects (Caves, 1985, 1998; Cantwell, 1992). On the other hand, negative effects can also be generated if there is a high degree of substitutability of the products supplied by domestic and foreign-owned firms and/or imported goods, and if foreign owned firms' R&D-activities are significantly more effective than those of domestic firms (Lee, 1996; Scherer and Hugh, 1992; Zimmerman, 1987). In contrast, there is evidence that intense *domestic* competition helps to generate highly competitive – or 'world-beating' industries (Porter, 1990). Given these considerations, we examine both the effects of the *extent* of competition and the effect of the *source* of competitive pressures on innovation.

The issues of competitive pressure on the one hand, and financial resources on the other, that Schumpeter (1947 and 1961) discusses as being important for innovative activities are also echoed in the literature on the effect of financial market pressures on firms. On the one hand there is an extensive literature on the effect of take-overs, and specifically the threat of hostile take-overs, on firms' R&D and other corporate behaviour (from the early contributions of, for example, Marris, 1964 and Singh, 1975 through to the current literature such as Franks and Mayer, 1996). On the other hand the now-fashionable push for 'free cash flow' to be transferred from firms to shareholders (via dividend pay-outs or share buy-backs) takes its academic lead from Jensen and Meckling's (1976) discussion of the nature and incidence of the costs of monitoring and of motivating agents working on behalf of a principal. One line of argument is that borrowing to fund investment projects will pressure management to ensure a high return, in order to meet the interest payments due on the debt. We therefore also examine below the effect of take-overs and debt interest payments on firms' innovative activity.

3. How Firms Compete

Before reporting on our formal tests for the relationships between, on the one hand the level and nature of competition and financial market pressure, and on the other hand, innovative performance, it is worth considering how firms actually compete. When firms were asked to identify the sources of their competitive advantage the key factors were ‘personal attention to client needs’, ‘reputation’, and ‘product quality’. ‘Cost advantage’ was the lowest ranked factor, especially amongst those firms with the fastest rate of growth. There were large and significant differences in competitive strategy between innovating and non-innovating firms, with statistically significant differences between the two sectors for seven out of the eleven competitiveness factors. The largest differences, in terms of rank as well as scores, were for product design, flair and creativity, product quality, specialised expertise or products, and range of expertise or products; all these factors were more important for innovating firms than they were for non-innovating firms. Further evidence of the differences in competitive factors was found when firms were asked to rate various factors as ‘very significant’ or ‘crucial’: innovating firms were far more likely to rank highly such factors as product design, flair and creativity, and specialised expertise or products, compared to non-innovating firms.

Overall, innovating firms stress the importance of higher-order qualitative factors that require investment in skills and technical capability. Conversely, in terms of rankings, they put less emphasis on cost and price factors compared with non-innovating firms. These major differences were also evident in an earlier survey assessing competitive advantage in 1990 (SBRC, 1992). This suggests that such differences do not merely reflect the contrast between firms that innovate and those that do not, but they also reflect differences between those firms that intend to innovate, or are receptive to such developments, and those that do not or are not.

4. Collaboration, Innovation, and Corporate Performance

It is widely recognised that collaboration is an important means of fostering innovation (see, for example, Dore, 1983). Half of the innovating firms in the CBR survey had entered into collaborative partnerships, whereas only one in six of the non-innovating firms had entered into such arrangements. Collaboration is particularly important for firms facing foreign competition; as the process of globalisation continues apace such collaborative behaviour may become more important as domestic firms face stiffer competition in both home and overseas markets. One of the important ingredients for achieving competitive success and for engaging successfully in innovative activity, appears to be to establish effective collaboration with others - customers, suppliers, higher education establishments and so on. Such collaboration allows firms to expand their range of expertise, develop specialist products, and achieve various other corporate objectives.[6]

The four most important reasons given by firms in the CBR survey for collaborating were to help expand the range of expertise and products, to assist in the development of specialist services and products required by customers, to provide access to UK markets, and to provide access to overseas markets. The process of collaboration allows firms to exploit economies of scale and scope. The reason given for collaboration that has shown the greatest increase since 1990 (from 29 per cent to 38 per cent) is to help keep current customers. This suggests that collaboration may have increased for defensive reasons - perhaps in response to increased domestic and international competition.

In general, innovating firms were more likely to collaborate for all reasons compared to non-innovating firms. The one exception was to help keep current customers, suggesting that non-innovators are more defensive in regard to maintaining market share. Additionally, and not surprisingly, the reason for collaboration for non-innovators that showed the greatest fall was the sharing of research and development.

The overall impact of increased innovation and collaboration is improvements in both output and employment growth rates - for individual businesses as well as for the economy as whole.[7] In terms of employment, fast growth firms were almost twice as likely to have collaborated compared to firms with negative or no growth firms. Innovating firms were far less likely to have zero or negative employment growth than were non-innovating firms and were far more likely to have achieved fast growth in employment. The CBR survey indicated a similar picture in the contrast between collaborators and non-collaborators - superior employment growth being shown by the collaborators. This superior performance of innovating firms and of collaborating firms was also apparent in terms of turnover growth and in terms of the growth of profit margins.[8]

5. Hypotheses Testing

In this section we test formally for any correlation between, on the one hand, the competitive environment faced by firms, financial market pressure and collaboration, with on the other hand the probability of innovating. Before doing so, however, it is necessary to emphasise that since much of the data used in our estimations are cross-sectional, inferences about causation need to be drawn with caution (see Fernie and Metcalf, 1995 for a detailed discussion of the problems of causation and simultaneity with cross-sectional survey data). To reduce problems of simultaneity between the dependent and explanatory variables, where the data are available the lagged value (obtained from the earlier surveys) of explanatory variables are used. It is important to stress therefore that what we are investigating here is the possible correlation between the explanatory variables such as profit margin growth, and the firm's innovativeness. We are not arguing that there is a simple, one-way causation. Indeed, we would expect any correlation we found to be the result of two-way causal relationships between symbiotic practices. The test for the relationships outline above, the following generalised reduced form equation is estimated:

$$(1) \qquad Y_{xt}^* = \alpha + \beta' X_{xt} + \gamma' \Omega_{xt} + \lambda' \Psi_{xt} + \theta' dcollab_{xt} + \varepsilon_{xt}$$

Where:

- Y_{xt}^*, indicates whether or nor a firm introduced a process or product innovation in the period 1992-95 (with $Y_{xt}^* = 1$ if $Y_{xt}^* > 0$, and = 0 otherwise)
- X_{xt} represents a vector of firm characteristics consistently found in the literature to be likely to influence innovative activity (see for example Cosh, Hughes and Wood, 1996, and Nickell and Nicolitsas, 1997). These are profit margin growth (pre-tax profits normalised by turnover growth, 1990-95), employment growth (1990-95), age (1995), size (measured by employment level in 1995), dummy variables for previous innovation (1986-91) and collaboration (1986-91), plus industry dummy variables (the excluded industry dummy is 'Other Manufacturing').
- Ω_{xt} is the competitive environment faced by the firm measured by the number of serious domestic and overseas competitors faced in 1991 (the year prior to the period covered by the innovation

questions, 1992-95).

- Ψ_{xt} represents financial market pressure faced by the firm measured by, firstly, whether the firm faced a take-over bid prior to 1991[9] and, secondly, the level of interest payments on debt in 1991 (normalised by turnover growth).

Our results are reported in Table 3 below. All estimates were made using Limdep 6.0. We report only the marginal effects, which are calculated as the derivative of the conditional expectation of the observed dependent variable and evaluated at the sample means, following the procedure in Limdep (Greene, 1995).[10]

The collaboration, competition, and finance variables all have the expected signs and are all statistically significant. Our initial probit results indicated a statistically significant correlation between higher levels of competition and a higher rate of innovation. However, on closer inspection of the data it appeared that this effect tailed off as the degree of competition increased and even became negative, giving an inverted U-shaped curve when the likelihood of innovating was plotted on the vertical axis and the degree of competition on the horizontal. We therefore repeated our original probit estimates of equation (1) including the square of the degree of competition as an additional variable, and we did indeed discover a negative coefficient, albeit not as significant as the positive coefficient on the degree of competition itself, but still significant at the 90 per cent confidence level. It was in an attempt to discover why the effect of competition changed beyond a certain point that we split the competition between domestic and foreign, including both in the probit estimates reported in Table 3 above. As can be seen, we were correct in our assumption that the different forms of competition would give us different results.

The results in Table 3 indicate that the measure of domestic competition continues to have a statistically significant positive coefficient, as does the number of overseas competitors initially, but it is this latter effect which becomes negative at higher degrees of competition. This is indicated by the statistically significant negative coefficient for the square of this measure. Thus it is *not* the case that just because domestic competition has certain effects on the innovative (and other) behaviour of firms, competitive pressure from foreign firms will necessarily have the same effects.

Having innovated and collaborated over the period 1987-91 were statistically significant and positively correlated with innovating in 1992-1995 period, results we return to in the paper's conclusion. Size as measured by employment is also significant, although this is not surprising since a large firm is more likely to have introduced at least one innovation than is a small firm. The size effect is most significant in relation to product innovation.

A take-over bid prior to 1991 has a very negative relation to future product innovation but is only marginally significant for process innovation. This may reflect the fact that innovations make firms attractive for take-over bids, and that product innovations (and the prior investments in developing them) tend to be more visible types of innovations than are process innovations. Thus if the threat of hostile take-over bids were to discourage investment in innovation, it would be likely to discourage product innovation in particular. Debt repayments were statistically significant, although only at the 90 per cent level, and this would be picking up not only the disciplining effect hypothesised by the Jensen and Meckling-type arguments currently in vogue with the move to force 'free cash flow' from firms, but also the more mundane factor that firms which innovate are more likely to have had to borrow in order to fund that innovation than are firms which have decided to rest on their laurels.

In addition to the above point about overseas competition having a perverse effect at higher levels, overseas competition was also found to be less significant for process than product innovation, which again may reflect the more visible nature of product innovation and the feeling that overseas competition needs to be met in a visible way. The industry dummies indicate that producing in the engineering and chemical industries is positively and significantly correlated with *product* innovation (column 2) and in the case of engineering, positive and significant for the overall probability of innovating (column 1), whereas producing in the service sector is negatively and significantly correlated with *product* innovation (column 2) but positively and significantly correlated with *process* innovation (column 3).

6. Conclusions and Policy Implications

What might explain these results, of market competition apparently benefiting from cooperation? The issue of whether the competitive environment promotes innovation or price cutting has been examined in detail by Lazonick (1991) who argues that the key determinant of whether or not the firm's decision makers choose an innovative strategy is the extent to which ‘they control an organisational structure that they believe provides them with the capability of developing productive resources that can overcome the constraints they face’ (Lazonick, 1991, p. 328). Such structures include not only the internal organisation of firms themselves and their relationships with the public authorities but also networks of relationships between firms in a particular industry or cluster of industries.

Lazonick’s emphasis on the need for control over the requisite organisational structure derives at least in part from his own work as an economic historian on the failure of the British cotton industry to innovate. Referring to a period of stagnation following the end of the post-World War II boom, Lazonick characterizes the situation in the following terms:

> The fundamental problem was an industry mired in its own highly competitive and vertically specialised structure, lacking any internal forces to set organisational transformation in motion (Lazonick, 1986, p. 35).

The vast majority of businesspeople in the cotton industry had neither the incentive to participate nor the ability to lead in the internal restructuring of their industry (*ibid.*, p. 45). Given this absence of leadership from within private industry, what was required was the visible hand of co-ordinated control not the invisible hand of the self-regulating market (Elbaum and Lazonick, 1986, pp. 10-11).

The issue of the relationship between industry structure and the capacity for innovation is a complex one. On the one hand, there is evidence that forms of long-term relationship between independent firms may be superior to vertical integration as a means of co-ordinating the activities required for innovation, especially where these activities involve a high degree of technological ‘strangeness’ (Gomes-Casseres, 1994, p. 63). These new forms of alliance are prevalent in high technology industries. There are indications that they contribute most to innovative performance when they involve a dense network of interpersonal relationships and internal infrastructures that enhance learning, unblock information flows and facilitate coordination by creating trust and by mitigating perceived differences of interest (Porter, 1990, pp. 152-3; Moss Kanter, 1994, p. 97).[11]

These points regarding information flows and so forth were also brought out by Dore (1983) in his discussion of the 'obligated relational contracting' found between Japanese firms. This involves long-term trading relations in which goodwill (with 'give and take') is expected to temper the pursuit of self-interest, although this and other labour market practices have since come under strain, especially following the relatively slow economic growth of the 1980s.[12] In his

1983 article Dore argued that such relations were more common in Western economies than is generally recognised. While it may be objected that relational contracts lead to price-distortions and hence to a loss of allocative efficiency, they do lead to high levels of other kinds of efficiency. Specifically, 'the relative security of such relations encourages investment in supplying firms', 'the relationships of trust and mutual dependency make for a more rapid flow of information', and 'a by-product of the system is a general emphasis on quality'. This discussion links to a number of classic papers (such as Richardson, 1972, and Mariti and Smiley, 1983), with Dore citing Macaulay's 1962 paper as demonstrating that relational contracting is indeed valued by firms in the USA as well as in Japan.

In light of such considerations it should perhaps be unsurprising that our analysis of the probability of innovating should have found on the one hand a statistically significant, positive coefficient for competition (consistent with Nickell, 1996) while one the other hand also finding a statistically significant, positive coefficient for collaboration.

It appears, however, that it is not just the *degree* of competition which is important but also the *nature* of the competitive process, and whether this involves collaborative activity, including between competitors. Our results are thus consistent with the tests by Malerba and Orsenigo (1995) of ‘Schumpeter Mark I’ versus ‘Schumpeter Mark II’ (on which, see the discussion above) who find that ‘stability’ emerges as an important feature of the patterns of innovative activity: ‘technological performance is strongly associated with the emergence of a stable group of innovators, who innovate consistently and continuously over time, rather than with concentration or firm size’.

This is consistent with our idea that it is the nature of the competitive process rather than just the degree of competition that is important, with co-operative activity also being significantly positively correlated with the likelihood of innovating.[13]

Thus the effect of increasing competition is not a simple linear process. One reason for this is that the competitive process involves a significant degree of co-operation between firms and other bodies, including between competitor firms themselves. Our conclusion is that the preferred degree of competition should not be seen in quantitative terms alone but also in qualitative terms, regarding the type of relationships that the firms in question are able to develop and the sorts of pressures (such as the threat of hostile take-over) that the managers of those firms face.

Given these apparent benefits of collaboration, why do more firms not enter into such arrangements? In part the answer may lie in the short-termism that prevails in many firms and industries, and a financial system more geared to quick pay-back periods and a high priority to maintaining dividend payout levels than to long-term investment commitments.[14] Moreover, as illustrated in Table 3, a financial system that is geared toward activities such as hostile takeovers can also contribute to poor firm performance (for example, firms that faced a take-over bid in 1991 were significantly less likely to have innovated in the 1992-95 period). The attempt to squeeze productivity growth out of UK firms during the 1980s and 1990s via the intensification of competitive pressures allied with the opening up of cost-cutting competitive avenues may have had two contradictory effects. Firstly, recording what have been interpreted by some as impressive and welcome productivity growth figures (Crafts, 1996; Eltis, 1996), while at the same time undermining the conditions for long-term, sustainable economic development.

We conclude by considering the policy implications of our analysis. The fostering of collaborative structures may be an important element in creating a competitive and successful economy - an economy capable of closing the output gap with its major competitors.[15] This opens up a very different policy agenda than that which was pursued in the UK during the 1980s and 1990s. Instead of ‘freeing up’ of labour and product markets through policies of deregulation and casualisation we need industrial, innovation, and macroeconomic policies which will develop new forms of corporate finance and create effective mechanisms of corporate governance; provide a modern productive infrastructure which private firms can utilise, in many cases in a cooperative fashion; ensure a macroeconomic regime conducive to the creation of new industrial capacity, including low interest rates and a competitive exchange rate; ensure the expansion of employment opportunities so that investment in education and training will translate into the increased output levels which in the long run will repay such investments; and promote productive cooperation and industrial innovation. On this last point of promoting innovation, policy should distinguish the different determinants of innovation between types of innovating firm so that the particular policy targets can be more effectively hit.

Notes

1. See Bullock, Duncan and Wood (1996) and Cosh, Duncan and Hughes (1996) for more detail of the surveys. See also Wood, 1998.

2. Firms were classified as innovators or non-innovators on the basis of their answer to the following question: "Has your firm introduced any innovations in products (goods or services) or processes during the last three years which were new to your firm?"

   The definition of a *product* innovation was as follows: 'a new or significantly improved manufactured or service product which is introduced to the market and requires changes in knowledge or skills, routines, competence, equipment, or engineering practices to make the new product. Changes which are purely aesthetic (such as changes in colour or decoration) or which simply involve product differentiation (minor design or presentation changes which leave the product technically unchanged) are NOT to be classified as product innovations.'

   The definition of *process* innovation was as follows: 'a new or significantly improved production, delivery or distribution method and which requires changes in knowledge or skills, routines, competence, equipment, or engineering practices to introduce the new process'.

3. Firms were classified as collaborators or non- collaborators

on the basis of their answer to the following question: 'Has your firm in the last three years entered into formal or informal collaborative or partnership arrangements with any other organisations?'

4. There is some evidence of fewer competitors in manufacturing than in services, although there is no clear pattern in the differences between innovators and non-innovators, or between collaborators and non-collaborators. For a study of innovation in the financial services sector which includes a useful discussion of the specifics of services, and which focuses on the importance of communication in the innovation process, see Lievens and Moenaert (2000).

5. The label 'Schumpeter Mark I' for the theory proposed by Schumpeter (1961) comes from Nelson and Winter (1982), and Kamien and Schwartz (1982), as discussed by Malerba and Orsenigo (1995).

6. This issue of collaboration between firms raises a separate issue beyond the scope of this article, namely the question of when collaboration becomes collusion, and how this is (and should be) handled in the context of competition policy. Oughton and Whittam (1996) contains an interesting discussion of the relation between cooperation between firms on the one hand and competition policy on the other, combined with an analysis of the benefits to be had from reaping internal and external economies of scale.

Cooperative external economies of scale enable small and medium sized enterprises to pool fixed costs which can result not only in greater efficiency but also, by overcoming entry barriers, thereby increase competition. Thus public sponsorship of such cooperative industrial activities should not be seen as necessarily at odds with promoting competition. But a failure to appreciate this point could lead to a simple-minded competition policy failing to promote such cooperation – or even outlawing it – thus actually undermining the conditions for healthy competition. On these issues of competition policy, see also Deakin, Goodwin, and Hughes, 1997. This discussion also cuts across the distinction that can be made between the different views of the innovation process – and the roles played within this by competition on the one hand, and large firms able to fund R&D on the other – within Schumpeter's *Capitalism, Socialism and Democracy* (1947) and *The Theory of Economic Development* (1961).

7. Note that our data are all for small and medium sized enterprises. There is a mass of evidence to suggest that collaboration between firms of roughly comparable size tends to be of a very different nature from that between large and small firms where the power relations are quite different. See the discussion by Oliver and Blakeborough (1998).

8. For further discussion of the employment, turnover, and profit data see Cosh, Hughes, and Wood (1996) and Cosh and Hughes (1996).

9. The Take-over variable is availably only for the 1987-91 period.

10. Since dummy variables can only change in discrete amounts, some argue (e.g., see Long, 1997) that these effects should be calculated as the percentage predicted change evaluated at the discrete change in the dummy variable. Since we found little difference between these two sets of calculations, we here report the more usual marginal effect calculations.

11. For further discussion of the role of trust see the March 1997 Special Issue of the *Cambridge Journal of Economics* on Contracts and Competition, and in particular the Introduction by Deakin and Michie and the papers by Arrighetti, Bachmann and Deakin; Lane; and Burchell and Wilkinson. See also Deakin and Michie (1997), and Deakin, Goodwin and Hughes (1997).

12. A point taken up by Dore (1998).

13. Our results in Table 3 show that the dummy variable for having innovated in 1991 was positively and statistically correlated with the likelihood of innovating in 1995. This is also consistent with the Malerba and Orsenigo finding regarding the importance of a stable group of innovators.

14. An additional problem of a pricipal-agent may occur where the financial sector is dealing with networks or other alliances of firms, the legal definition of which may not be entirely clear.

15. Indeed, when releasing a report in 1997 showing that British firms had reduced spending on innovation in 1996 – at a time when the lifespan of their established products was falling – the UK’s Confederation of British Enterprise warned manufacturers that they would go to the wall unless they invested in developing new products. Interestingly from the point of view of the analysis presented in here, this report also indicated that the growth in collaboration between manufacturing companies and academics, universities and consultants had ended.

TABLES

Table 1 Concentration of sales (% distribution of firms)

% of sales for largest customer	less than 10%	10%-24%	25%-49%	50%-100%	No. of firms
Micro	19.7	38.2	29.2	13.0	169
Small	25.8	43.0	20.1	11.2	375
Medium	40.3	32.8	14.9	11.6	65
Large	41.3	34.8	15.2	9.7	44
Manufactur'g	26.8	41.2	19.6	12.4	347
Services	26.6	39.5	23.5	10.4	309
Innovators	28.8	40.7	21.8	8.8	441
Non-innovators	21.7	40.1	20.7	17.5	206
All	26.7	40.4	21.4	11.5	656

Source: University of Cambridge, ESRC Centre for Business Research, 1995 Survey into Growth, Innovation and Competitive Advantage in Small and Medium Sized Firms.

Table 2 Competitive structures (% distribution of firms)

Number of serious competitors	All	Manufacturing	Services	Innovator	Non-innovators	Collaborators
0 (monopoly)	3.3	2.9	3.6	2.5	5.0	2.0
1-9 (highly segmented)	61.3	69.1	52.4	60.9	63.9	60.5
10-49 (partially segmented)	27.3	23.6	31.5	29.3	20.6	29.0
50-99 (partially atomistic)	2.6	1.2	4.3	2.5	3.0	3.6
100 + (highly atomistic)	5.5	3.3	8.2	4.8	7.5	4.8

Source: University of Cambridge, ESRC Centre for Business Research, 1995 Survey into Growth, Innovation and Competitive Advantage in Small and Medium Sized Firms.

Table 3. Probit Estimates of Innovation, 1992 – 1995

Variable	Product/Process Innovation (1)	Product Innovation (2)	Process Innovation (3)
intercept	-2.807	-2.427	-3.226
	(-2.612)**	(-3.725)***	(-3.962)***
log of profit margin growth (1990-95)[a]	0.198	0.129	0.268
	(1.511)	(1.284)	(1.935)*
log of employment growth (1990-95)	0.106	0.096	0.133
	(0.798)	(0.762)	(0.811)
log (employment size)	0.329	0.434	0.235
	(1.345)	(1.830)*	(1.542)
dummy if innovated, 1986-91	0.855	0.954	0.817
	(4.114)***	(4.719)***	(4.002)***
dummy if collaborated, 1986-91	0.648	0.816	0.612
	(3.124)***	(3.351)***	(2.923)***
dummy if Chemicals	0.127	0.226	0.201
	(1.224)	(1.815)*	(1.127)
dummy if Engineering	0.232	0.295	0.096
	(1.927)*	(1.988)*	(1.365)
dummy if Textiles/clothing	-0.138	-0.197	-0.111
	(-1.242)	(-1.525)	(-1.084)
dummy if Food/drink	0.142	0.158	0.123
	(1.124)	(1.216)	(1.006)
dummy if Services	0.272	-0.236	0.502
	(1.640)	(-2.007)*	(2.578)**
log (number of domestic competitors in 1991)	0.534	0.490	0.675
	(3.905)***	(3.188)***	(4.332)***
log (number of domestic competitors in 1991)^2	0.057	0.060	0.039
	(1.002)	(1.012)	(0.927)
log (number of overseas competitors in 1991)	0.398	0.482	0.317
	(2.226)**	(2.815)***	(1.823)*
log (number of overseas competitors in 1991)^2	-0.156	-0.167	-0.128
	(-1.817)*	(-1.926)*	(-1.266)
takeover bid, 1986-91	-0.545	-0.615	-0.249
	(-2.321)**	(-3.351)***	(-1.695)
log (interest payments)[b]	0.291	0.313	-0.260
	(1.976)*	(2.019)*	(-1.871)*
Log-likelihood (Log L)	-163.8	-155.8	-102.5

Adjusted R^2	0.085	0.074	0.062
N[c]	443	331	299

Notes: ***, ** and * denote significance of t-statistics at the 99, 95 and 90 per cent level respectively.

[a] Normalised on turnover growth.

[b] Normalised on turnover growth.

[c] The firms used in this estimation include only those firms which responded to both the 1991 and 1995 survey and also answered the innovation questions in both surveys.

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1.See Bullock, Duncan and Wood (1996), and Cosh, Duncan and Hughes (1996) for more detail of the surveys. See also Wood, 1998.

2.Firms were classified as innovators or non-innovators on the basis of their answer to the following question: 'Has your firm introduced any innovations in products (goods or services) or processes during the last three years which were new to your firm?'

The definition of a *product* innovation was as follows: 'a new or significantly improved manufactured or service product which is introduced to the market and requires changes in knowledge or skills, routines, competence, equipment, or engineering practices to make the new product. Changes which are purely aesthetic (such as changes in colour or decoration) or which simply involve product differentiation (minor design or presentation changes which leave the product technically unchanged) are NOT to be classified as product innovations.'

The definition of *process* innovation was as follows: 'a new or significantly improved production, delivery or distribution method and which requires changes in knowledge or skills, routines, competence, equipment, or engineering practices to introduce the new process.'

3.Firms were classified as collaborators or non-collaborators on the basis of their answer to the following question: 'Has you firm in the last three years entered into formal or informal collaborative or partnership arrangements with any other organisations?'

4.There is some evidence of fewer competitors in manufacturing than in services, although there is no clear pattern in the differences between innovators and non-innovators, or between collaborators and non-collaborators. For a study of innovation in the financial services sector which includes a useful discussion of the specifics of services, and which focuses on the importance of communication in the innovation process, see Lievens and Moenaert (2000).

[5] The label ‘Schumpeter Mark I’ for the theory proposed by Schumpeter (1961) comes from Nelson and Winter (1982) and Kamien and Schwartz (1982), as discussed by Malerba and Orsenigo (1995).

6.This issue of collaboration between firms raises a separate issue beyond the scope of this article, namely the question of when collaboration becomes collusion, and how this is (and should be) handled in the context of competition policy. Oughton and Whittam (1996) contains an interesting discussion of the relation between cooperation between firms on the one hand and competition policy on the other, combined with an analysis of the benefits to be had from reaping internal and external economies of scale. Cooperative external economies of scale enable small and medium sized enterprises to pool fixed costs which can result not only in greater efficiency but also, by overcoming entry barriers, thereby increase competition. Thus public sponsorship of such cooperative industrial activities should not be seen as necessarily at odds with promoting competition. But a failure to appreciate this point could lead to a simple-minded competition policy failing to promote such cooperation - or even outlawing it - thus actually undermining the conditions for healthy competition. On these issues of competition policy, see also Deakin, Goodwin, and Hughes, 1997. This discussion also cuts across the distinction that can be made between the different views of the innovation process - and the roles played within this by competition on the one hand, and large firms able to fund R&D on the other - within Schumpeter's *Capitalism, Socialism and Democracy* (1947) and *The Theory of Economic Development* (1961).

7.Note that our data are all for small and medium sized enterprises. There is a mass of evidence to suggest that collaboration between firms of roughly comparable size tends to be of a very different nature from that between large and small firms where the power relations are quite different. See the discussion by Oliver and Blakeborough (1998).

8. For further discussion of the employment, turnover, and profit data see Cosh, Hughes, and Wood (1996) and Cosh and Hughes (1996).

[9] The take-over variable is available only for the 1987-91 period.

[10] Since dummy variables can only change in discrete amounts, some argue (e.g., see Long, 1997) that these effects should be calculated as the percentage predicted change evaluated at the discrete change in the dummy variable. Since we found little difference between these two sets of calculations, we here report the more usual marginal effect

calculations.

11. For further discussion of the role of trust see the March 1997 Special Issue of the *Cambridge Journal of Economics* on Contracts and Competition, and in particular the Introduction by Deakin and Michie and the papers by Arrighetti, Bachmann and Deakin; Lane; and Burchell and Wilkinson. See also Deakin and Michie (1997), and Deakin, Goodwin and Hughes (1997).

12. A point taken up by Dore (1998).

13 Our results in Table 3 show that the dummy variable for having innovated in 1991 was positively and statistically correlated with the likelihood of innovating in 1995. This is also consistent with the Malerba and Orsenigo finding regarding the importance of a stable group of innovators.

14. An additional problem of a principal-agent nature may occur where the financial sector is dealing with networks or other alliances of firms, the legal definition of which may not be entirely clear.

15. Indeed, when releasing a report in 1997 showing that British firms had reduced spending on innovation in 1996 - at a time when the lifespan of their established products was falling - the UK's Confederation of British Enterprise warned manufacturers that they would go to the wall unless they invested in developing new products. Interestingly from the point of

view of the analysis presented in here, this report also indicated that the growth in collaboration between manufacturing companies and academics, universities and consultants had ended.

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