

Firm Size and Efficiency in Innovation: Reply

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Economic activity moved away from large firms to small, predominantly young firms in the 1970s and 1980s. Acs and Audretsch (1993) and Carlsson (1992) show evidence of manufacturing industries in countries in varying stages of economic development. Carlsson mentions two explanations for this shift. The first deals with fundamental changes in the world economy from the 1970s onwards. These changes relate to the increase of global competition, the rising degree of uncertainty and the growth in market fragmentation. The second deals with changes in the character of technological progress. He shows that flexible automation has various effects resulting in a shift from large to smaller firms. The pervasiveness of these changes results in a structural shift which affects the economies of all industrialised countries. Piore and Sable (1984) also argue that the market instability resulted in the demise of mass production and promoted flexible specialisation. This fundamental change in the path of technological development led to the occurrence of vast diseconomies of scale.

This shift away from large firms is not confined to manufacturing industries. Brock and Evans (1989) show that this trend has been economy-wide at least for the United States. They provide

us with four more reasons as to why this shift has occurred: the increase of labour supply; changes in consumer tastes; relaxation of (entry) regulations and the fact that we are in a period of creative destruction. Loveman and Sengenberger (1991) stress the influence of two trends of industrial restructuring: that of decentralisation and vertical disintegration of large companies and that of the formation of new business communities. Furthermore they emphasize the role of public and private policies promoting the small business sector.

The question whether this change of the size class structure of industries has influenced their economic performance is underresearched. Here we are concerned with one of the most important questions in economics: why do industries thrive? The link between industrial organization and economic growth has always been the subject of considerable debate. Traditionally, the prevalent assumption was that giant companies are at the heart of the process of innovation and creation of welfare. This assumption is generally referred to as the Schumpeterian hypothesis. Recently, the debate centers around the question whether the process of decentralisation and deconcentration, which virtually every industrialised country has experienced in the last two decades, has had positive welfare implications. Audretsch (1995) refers to "the new learning" when discussing this shift in orientation of our social-economic thinking.

The question of the link between the shift in the industrial structure and subsequent growth can be answered in two ways. First, by investigating the many consequences of the shift. For instance, one may study whether this shift has been favorable for the process of innovation and rejuvenation of industries. See Acs and Audretsch (1990), Audretsch (1995) and Cohen and Klepper (1996).

Final version accepted on

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Alternatively, one may zoom in on the discussion of the relation between the role of small firms and competition and industry dynamics. See Audretsch (1995) and You (1995). Moreover, the role of small firms in the job creation process, usually treated as a controversial topic despite countless studies showing that small firms are a major engine in this process, may be dealt with. Davis, Haltiwanger and Schuh (1996) and Carree and Klomp (1996) provide a recent discussion. Lastly, the role of small firms as a vehicle for entrepreneurship may be the focal point of our attention. Baumol (1993) deals with the role of entrepreneurial activities and their consequence for prosperity throughout history. Acs (1992) has been one of the first to bring it all together in a short descriptive manner and to survey some consequences of the shift of economic activity from large to smaller businesses. His view is that small firms play an important role in the economy serving as agents of change by their entrepreneurial activity, being the source of considerable innovative activity, stimulating industry evolution and creating an important share of the newly generated jobs. The evaluation of the various consequences of this shift is difficult but necessary to establish whether it is desirable and to be promoted by economic policy. It is difficult because none of these consequences is, in fact, independent from the other three and because the evaluation offers something of a series of trade-offs. See Audretsch and Thurik (1997). For instance, small businesses may contribute to higher growth because of their contribution to the selection process due to their variety. On the other hand, however, the selection process may lead to a lower level of stability and, hence, to welfare losses. Or, while employment levels may rise as firm size declines, the lower average wages small firms pay may at least partly offset the welfare effect induced by the employment growth.

A second way to answer the question is to circumvent the intermediary variables between the shift in the industrial structure and growth like technological change, entrepreneurship, competitiveness and job generation. The question becomes whether there is a direct link between this shift and performance measures like growth or productivity. Some preliminary empirical results of the relation between changes in the firm size distribution and

economic growth are presented in Thurik (1996). The analysis shows a positive effect of an increase in the economy-wide share of small firms on growth in GDP for European countries in a recent period. The interpretation of this result is somewhat difficult because it is not clear whether changes in the economy-wide share of small firms result mainly from changes in the sectoral composition or from downscaling in specific industries. Moreover, the papers lack a theoretical component. Schmitz (1989) presents an endogenous growth model which relates entrepreneurial activity and economic growth. He shows that an increase of the proportion of entrepreneurs in the working force leads to an increase in long-run economic growth. His model also implies that the equilibrium fraction of entrepreneurs is lower than the social optimal level, providing a rationale for policies stimulating entrepreneurial activity. The size class structure of an industry and the proportion of entrepreneurs in its working force are strongly related. This paper lacks an empirical backup. Carree and Thurik (1998) present a new model linking performance and firm size distribution. They combine the theory approach of Schmitz and empirical one of Thurik. The two mechanisms governing the link between performance and firm size are ease of entry of new firms and ease of change of incumbent firms. It attempts to supplement the Schmitz-model at the industry level. Empirical tests of the link between smallness and growth are provided using a sample of 14 manufacturing industries in 13 European countries for the period 1990–1994. By dealing with data at a relatively low industry level the disturbing influence of changes in sectoral composition is eliminated. In this sense it supplements Thurik's earlier approach. Their results indicate that an industry with a low large firm presence relative to the same industries in other countries has performed better in terms of growth of output. This suggests that lagging behind in the industrial restructuring process has come at a cost of lower economic growth.

In Van Dijk, Den Hertog, Menkveld and Thurik (1997) the first way is chosen to answer how industrial structure is influencing growth. In particular, the relation between structure and innovativeness is examined and whether size plays a role in this relation. Their approach builds on that

of Acs and Audretsch (1987a, 1987b and 1988). Brouwer (1998) comments this approach and its findings. The discussion of the role of smallness when linking structure to growth is an important one, particularly in Europe. "Small business has to save us" is a slogan often heard from European politicians and representatives of social and institutional groups. They fear for a further rise of the already unacceptably high level of unemployment caused by the endless series of efficiency and cost-cutting operations of the public and large business sectors. They hope that employment can be fought by stimulating smallness. This hope is based upon three assumptions. First, stimulating smallness, whatever it may be, lifts the dependency on possibly sluggish and transient resources like scale, scope and experience, and intensifies the dependency on resources like adjustment and effectiveness. The latter resources are likely to be more robust against uncertainty and change than the former. Secondly, stimulation of smallness means stimulation of labour intensity and hence employment by definition. See Loveman and Sengenberger (1991). Finally, stimulation of smallness implies an increase in the variety of the range of products and services offered. This not only paves the way for a competitive selection process, and a process with different innovative approaches (Cohen and Klepper, 1992) but may also satisfy a fragmented and differentiated demand. The study of Van Dijk, Den Hertog, Menkveld and Thurik (1997), the discussion of Brouwer (1998) and the present reply deals with the role of smallness in this process, and with the first and third of the above assumptions in particular.

Brouwer (1998) discusses the results of Van Dijk, Den Hertog, Menkveld and Thurik (1997) and focuses on the comparison of their results with those reported in Acs and Audretsch (1987a, 1997b and 1988). In her second paragraph Brouwer states that . . . "small firms have more to gain from innovation, because it will boost their profits more. Even stronger, this applies with greatest force when new firms can reach large size quickly". This would suggest that innovation in itself needs some scale to become profitable and that small firms could not develop "small" innovative activities, such that their relative innovative activity would equal that of larger firms. This

would mean that large size needs to be reached. It is hard to find any references to such an assertion. The counterexample is that of small niche firms improving or renewing their process or product, in order to serve their (small) market segments even better.

In the paragraph starting with "One of the interesting results" . . . Brouwer seems to hint at the incomparability of the Acs and Audretsch (1987a) article on the one hand and Acs and Audretsch (1987b) and Acs and Audretsch (1988) on the other. In the former paper an innovation rate measure is used and the latter two papers use an analysis based on innovation share. She states that "The large/small firm innovation shares differ from innovation rates. Small firms produced 43 per cent of all innovations, which is the result of a lower employment share (33.3 per cent) and higher efficiency." The question here is why this result would not also be found using the innovation rate approach? If small firms show higher innovation shares than employment shares they must show higher innovation rates. In Van Dijk, Den Hertog, Menkveld and Thurik (1997, pp. 335–336) it is stated that "The innovation rate always is a variable at the four digit industry level, defined as the total number of innovations in 1982 in a certain industry divided by some measure of size."

In their introduction Van Dijk, Den Hertog, Menkveld and Thurik (1997) state that they are aware of the pros and cons of R&D measures and alternative measures of innovation. Although Brouwer takes the position of strict incomparability, Van Dijk, Den Hertog, Menkveld and Thurik (1997) take the approach of learning from studying the phenomenon by taking a perspective in terms of country, innovation measure and aggregation level which all differ from that used by Acs and Audretsch. This is explicitly mentioned in their abstract. Furthermore, no conclusive evidence is given yet in the literature on the relationship between R&D intensity and innovation rate and role of different variables in this relationship.

In the final part of her comment Brouwer asserts that "These differences raise some doubts concerning the validity of the informal R&D data." Why should differences raise doubt on validity? One could also take the approach that

small firms cannot refrain from developing R&D activities in an informal way. They simply do not have the manpower to raise a formal R&D laboratory and assign full-time people to R&D activities. Hence, it is difficult to agree with Brouwer in her doubts. Moreover, Van Dijk, Den Hertog, Menkveld and Thurik (1997), refer to Kleinknecht (1987) for an elaboration on the downward biases inherent to measures of small-firm R&D. We agree with Brouwer in that small firms might have inflated their R&D activities to obtain subsidies.

Lastly, Brouwer attempts to criticize in a general way the studies of innovation in large and small firms. She tries to validate her point that informal R&D should not be used by making several sidesteps and trying to convince the reader that higher relative R&D activities for small firms do not seem likely. This of course is a entirely separate study.

Brouwer's comments need to be interpreted as a call for more and more precise replication of empirical results. The attempt of Van Dijk, Den Hertog, Menkveld and Thurik (1997) to compare their results with those of Acs and Audretsch meets Brouwer's critique where the results cannot be compared completely. This, however, is precisely their intention: to learn from differences in approach. What is common practice in the medical sciences, has become rare in the economic sciences. Replication of empirical work controlling for different setups should be encouraged. Where this is an established route of building up a knowledge base in other sciences with a strong empirical tradition, it seems to be somewhat out of fashion in the economic sciences. In particular, in the area of the determinants of growth and the role of smallness more comparative work is required. Europe needs persistent economic growth in view of its high level of social security and the political barrier to lower this level. Moreover, there is a widespread belief that smallness plays an important role in the link between what can be influenced by politicians, viz. economic structure including institutions, and growth. Work is required to substantiate this belief and to underpin the mechanism linking structure and growth. Clearly, innovation is part of this mechanism.

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