

Discussion of Stan Metcalfe's 'The Evolution of Industrial Dynamics' (<http://www.druid.dk/ocs/viewabstract.php?id=605&cf=3>)

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Industrial dynamics, Metcalfe and DRUID

More than 50 years ago Schumpeter said that 'nobody seems to understand or even to care precisely how industries and individual firms raise and fall and how their raise and fall affects the aggregates'.¹ The leading econometricians and theorists could answer that they lacked the relevant data and concepts. We now have relevant microdata, but there is still a lack of theoretical frameworks, and it is here Stan's long-term efforts become relevant. I still remember that even before DRUID was established 10 years ago, we had a workshop with Stan and here he remarked that the concepts of industry studies needed 'a hell of a lot of sharpening up'. The present paper sharpens our understanding of the raise and fall of firms and industries and the effects on the aggregates. He plans later to make a major extension of the coverage, so maybe we are facing the beginnings of a book on the foundations of evolutionary analysis. Such a book would be very important since the analysis of industrial dynamics is very complex and since the paper includes very difficult discussions, but I guess Stan is reluctant to answer questions on his future work.

Capitalist industrial dynamics

Stan starts with his vision of capitalism as a system of innovation and selection. He agrees with Schumpeter that resting capitalism is dead capitalism. In contrast, living capitalism is basically a process of restless industrial experimentation in which markets promote firms with supernormal technology and organisation, while subnormal firms are

¹ Schumpeter (1987, p. 329) at the Conference on Business Cycle Research, November 1949.

eliminated. We have to understand this process in terms of the statistical characteristics of populations of heterogeneous firms. Many researchers simplify this analysis by very restrictive assumptions, but not Stan. He tries to persuade us always to remember the complexity of the capitalist process. It is influenced not only by product markets but also by labour markets and capital markets; and these markets are intrinsically imperfect. The selection process takes place at the level of firms, plants, and work groups. And it is not enough to study the growth and decline of continuing units, and their innovation, learning, and internal reorganisation; we also need to study the effects of entry and exit as well as mergers and fissions.

Accounting for industrial dynamics

We need the equations of evolutionary population dynamics describe this process.² R. A. Fisher's equation tells us that the members of a population grow according to their distance from the average performance of the population. George Price has demonstrated that Fisher only covers a very simple selection process based on variance of performance. In Price's general equation, selection is defined as the variance times the efficiency of selection or, in other words, by the covariance between performance and growth. The change of average performance also includes an innovation effect based on the improvement of individual performance. It is this effect that sustains industrial dynamics.

Taken as a whole, the simple accounting system of Fisher and Price gives us the formal tools for analysing complex industrial dynamics. It can handle many forms of multi-level selection and it can include the effects of entry and exit. But can it be used in practice? Stan's answer is a clear yes, and he gives us four examples of how to do it. At the same time he gives a survey of the main areas of industrial dynamics. Thus, Stan is obviously able to use the accounting system, but I would like to hear his opinion on its

² Metcalfe seems to have reinvented these formulas before he found them in the works of R. A. Fisher and George Price. He (Metcalfe, 2002, p. 90) has stated that '[f]or some years now evolutionary economists have been using the Price equation without realising it.' This statement holds for Metcalfe's own contributions, but it has also some truth for Nelson and Winter's works.

usability for others—especially when we move from the simple cases to the real world of complex industrial dynamics.

1. Change in aggregate productivity

Stan first example is the notoriously difficult literature that study the change of aggregate productivity by means of time series data on individual firms or plants. This literature nicely fits the population dynamics approach—both when trying to explain productivity change and when trying to cover overall issues like the Schumpeterian process of creative destruction. Several descriptive methods have been developed,³ and they differ wildly in their conclusion. The reason is that they use different accounting systems.

Productivity effects, Canada 1988-1997

Comparison of decomposition results 1988–1997
(% contribution to labour productivity growth).

	Baldwin	Haltiwanger
Entry and exit	14	18
Reallocation among continuing firms	47	-5
Changes within continuing firms	39	98
Covariance of effects of continuing firms		-22
Total	100	100

Source: Baldwin and Gu (2004, pp. 15, 17).

The figure shows that we obtain very different results when two methods (Baldwin and Gu versus Foster, Haltiwanger and Krizan) are used on the same data. The reason is that Baldwin studies the output selection effect Haltiwanger study the employment selection effect. We only see relative agreement about the small black effects of exit and entry. In contrast, there is a huge difference with respect to the grey effects of selection between firms and the white effects of innovation within firms. While Baldwin's output selection effects accounts for nearly half of productivity change, the employment selection effects are close to zero. As a consequence, the within-firm change in productivity accounts for either roughly half or all of productivity change.

³ Like those of the late Zwi Griliches et al., John Haltiwanger of the National Bureau et al., and John Baldwin of Statistics Canada et al. (Baldwin & Gu).

Metcalfe's interpretation

The calculation of the selection effects depends on the distance between a firm's 'productivity' and the average 'productivity',⁴ but this distance is either multiplied by the change in the firm's employment share or by the change in its market share. Since employment shares change less than market shares, the employment selection effect is obviously smaller than the output selection effect. The problem is why this is the case. Stan is an expert in these matters (see Metcalfe, 1997), and his basic answer is that the firm is squeezed between imperfect markets for output and production factors. Therefore, we need several complementary methods of accounting, and he demonstrates that it is only under restrictive assumptions that they give the same result. He thus helps to sharpen up the discussion, but he does not comment on the so-called innovation effect—and this effect is either large or huge. So I would like to ask him how to explore this effect analytically. One answer might be that it can be decomposed into a real innovation effect and an effect that depends on the within-firm selection between plants or work groups. The within-firm selection effect is easy to understand, but the real innovation effect is partly due to the firm's attempt to cope with its selection environment. So there must be interactions between the market selection effect and the real innovation effect. The question to Stan is how to account for these interactions.

2. The industry life cycle

The area in which Stan's analytical tools *appears* to have least immediate power is the study of the industry life cycle. Stan summarises the empirical results about initially easy entry followed by an exit 'shakeout' and a relatively stable oligopoly. All the theories study industry dynamics in terms of a population of heterogeneous firms. Stan adds that the evolution is not only influenced by the output market but also by markets for labour and capital—and by government rules on, for instance, private contracts that hinder spin-offs. I think it should be possible for Stan to extend his analysis

⁴ The 'productivity' is either measured in terms of ordinary productivity or unit labour costs.

and thereby to give a clearer demonstration of the relevance of his basic analytical tools. For instance, he emphasises Klepper's result about the superiority of experienced spin-offs over inexperienced entrants in terms of long-run survival. He might use Price's equation to analyse the post-entry performance of these types. He can analyse Klepper's idea that core mother firms and their spin-offs have strong performance in terms of the positive selection and higher innovativeness of these families of firms. This accounting will check the ideas—and it would also demonstrate that selection can be studied at higher levels than that of the individual firm.

3. The differential growth of firms

When turning to the large literature on the differential growth of firms, Stan comes to a stronghold of analytical population dynamics, but this stronghold has been challenged since many studies find a weak or non-existent relationship between growth and relative productivities. We have already met this result in the general productivity studies, but Stan's Fisher–Price approach tells him that although an evolutionary process can take place in the presence of noise, it cannot do without a selection mechanism. Instead, he points out that there are a great variety of selection criteria and trade-offs between these criteria. Another issue is that the selection environment differs for small innovative entrants and large incumbent firms. In both cases, there might not be any totally general patterns, but still his evolutionary accounting can be applied. His idea of capitalism as an experimental combination of output markets and factor markets also helps both for analysis and policy. However, I miss a concrete example of how Stan can clarify the issues of differential growth of firms, but I guess that he has no time for elaborating such an example. So that is probably an issue for the book?

4. The macro effects of logistic industrial growth

A final discussion with a need of sharpening up deals with the microevolutionary foundations for macroeconomic performance. Parts of this discussion can be traced back to the 1930s when several economists

developed the theory of the retardation of overall growth due to the retardation of the growth in many industries. Schumpeter reacted against this theory, but there is still much need of sharpening it up. Stan's contribution is to give a Fisher–Price account for the effects underlying macro growth. The analysis is based on the variance of the growth rates of individual industries, and the retardation theory simply states that the average growth rate is negative and equal to the variance of growth rates. In this setting, the paths of shares of individual industries follow modified logistic curves with a phase of relative expansion followed by a phase of relative contraction. The result is that the structure of the capitalist economy as a whole is restless. However, Stan might want state his ideas of evolutionary growth in more traditional macroeconomic terms?

Conclusions

Stan's discussion of the four literatures on industrial dynamics demonstrates that his tools are useful for sharpening many discussions and for generating an overall understanding of the restlessness of capitalism. Much of this discussion can be used immediately in empirical studies, but I should emphasise that it is not easy to follow his suggestions. For most of us, it implies a movement away from our narrow specialities and a learning of the tools of statistical population analysis. I guess that quite a few would nevertheless like to follow his lead. Others would be more reluctant because they are not convinced about the blessings of unrestricted creative destruction. But even those who want to include the negative aspects of restless capitalism and the role of social countermeasures like the welfare state may apply the Fisher–Price approach. So there are many conflicting reasons for trying to persuade Stan to continue his work and to present it in a slightly more reader-friendly format.

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