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Firm lifecycles and evolution of industry productivity☆

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ABSTRACT

How do new firms contribute to industry productivity growth at the time of entry and then subsequently over their lifecycle? We analyze this question using a lifecycle decomposition approach and Finnish business-level microdata. New entrants have a negative effect on industry productivity growth initially, but a prolonged process of market selection and exit during the early stages of the firms' lifecycle mitigates this negative effect subsequently. The positive productivity contribution of market selection declines gradually, both because the failure rate decreases with age and also because the productivity gap between the exiting and surviving firms narrows. The most important source of industry productivity growth is, however, the average productivity growth of relatively old incumbents, i.e. their incremental renewal. Our lifecycle approach also provides novel viewpoints for policy.

1. Introduction

1.1. Motivation and contribution

That entry, market selection and reallocation of resources are instrumental both for aggregate productivity growth and for national competitiveness is widely recognized.[1] Several branches of the received literature shed light on these technology and competition-driven dynamic processes, including but not limited to industry life-cycle theory (e.g., Abernathy and Clark, 1985; Audretsch, 1991; Klepper, 1996; see Peltoniemi, 2011 for a review), Schumpeterian approach to economic development and industry evolution (Nelson and Winter, 1982; Dosi, 1988; Fagerberg, 2003), models of technology and innovation-based firm entry and growth (see, e.g., Henrekson and Johansson, 2010 and Coad, 2009 for reviews; and Lee, 2010 for a recent contribution), and endogenous growth theory (e.g., Romer, 1986; Aghion and Howitt, 1992; Hopenhayn, 1992).[2] These branches of research have not gone unnoticed by policy-makers, who are increasingly worried that the long-term competitiveness and growth of their economies are subdued because of inadequate micro-level dynamics and restructuring.

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[1] See Bartelsman and Doms (2000) and Syverson (2011) for a summary of the determinants of productivity growth and Furman et al. (2002) and Delgado et al. (2012) for a discussion of national innovative capacity and competitiveness. Van Praag and Versloot (2007) survey how small firms contribute to productivity growth.

[2] In endogenous growth theory, productivity growth is driven by accumulation of knowledge (Romer, 1986) or by innovations that either expand the variety of products (Romer, 1990) or enhance their quality (Segerström et al., 1990; Aghion and Howitt, 1992). The models featuring quality-improving innovations belong to the so-called Schumpeterian growth theory. Contrary to other endogenous growth theories, this strand of growth theory assigns an important role for a Schumpeterian process of creative destruction involving entry and exit of firms and reallocation of labor between firms (Aghion and Howitt, 2009).

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A particular policy to which many industrialized economies and regions resort to boost their productivity and competitiveness is that they actively promote new entry and the development of small businesses (see, e.g., European Commission, 2011, U.S. Small Business Administration, 2011 and Blair, 2010 for the case of Japan). This is somewhat puzzling, because new (and small) firms generally have lower productivity levels than the incumbents (see, e.g., Foster et al., 2001 and Jensen et al., 2001). If interpreted mechanically, this means that in the short-run, industry productivity would, ceteris paribus, be *higher* without new firms and small businesses.[3] The ultimate productivity effects of the policies that boost the creation of new firms, including variety-enhancing technology policy (Metcalfe, 1994), are therefore less linear than what many intuitively think and depend crucially on what happens to these new small businesses subsequently over their lifecycle. This dynamic process of firm and industry evolution is what the various branches of the received literature emphasize to a varying degree, but which they rarely attempt to quantify systematically, over many industries.

In this paper, we present an empirical evaluation of how new firms contribute to industry productivity growth both at the time of market entry and subsequently. We do so by quantifying the extent to which entry is followed by external restructuring (e.g., exit of low productivity and/or expansion of high productivity entrants) and internal restructuring (e.g., learning-by-doing among surviving firms) and by showing how the magnitude of these different productivity-improving mechanisms depends on the stage of firms' lifecycle.[4] This approach provides us with a window on the channels through which both new and growing firms as well as (more mature) incumbents contribute to the evolution of industry productivity.

We make, in particular, three contributions: First, we measure how large the initially negative effect of entry is relative to the other mechanisms that contribute to the industry productivity growth. Unlike the prior studies, we focus on showing how the magnitude of this effect depends both on the productivity gap between the young firms and incumbents and on the ability of the former to command resources (i.e., to gain market share in the market for inputs, such as labor). Our second contribution is that we demonstrate that being able to distinguish between these two factors (i.e., size of the gap and market share) is important for understanding the subsequent lifecycle effects of new entry. It allows us to quantify, for example, the extent to which subsequent market selection and exits remove the initial negative effect and how that happens. Our third contribution is that we provide new insights on how the productivity-enhancing firm renewal and (re)allocation of resources between the surviving firms are concentrated over the firms that are at different ages.

The lifecycle approach also provides novel viewpoints for policy, as it helps the policy-makers to understand better the expected effects of policies that boost the creation of new firms and to see why those effects may come about with a non-negligible lag. Moreover, the approach helps in developing complementary policies that enhance the evolution of industry productivity and the efficiency of the innovation ecosystem.

[3] This interpretation should not be taken literally, as we do not know the counterfactual, e.g. how the incumbent firm would have reacted had there been no entry. We thank a referee for emphasizing this viewpoint.

[4] A number of earlier papers acknowledge that how a firm contributes to the productivity growth of an industry may depend on the stage of the firm's lifecycle (e.g., Foster et al., 2001; Aw et al., 2001; Disney et al., 2003; Foster et al., 2006; Foster et al., 2008; Bellone et al., 2008). However, none of these papers use a coherent decomposition approach like we do here.

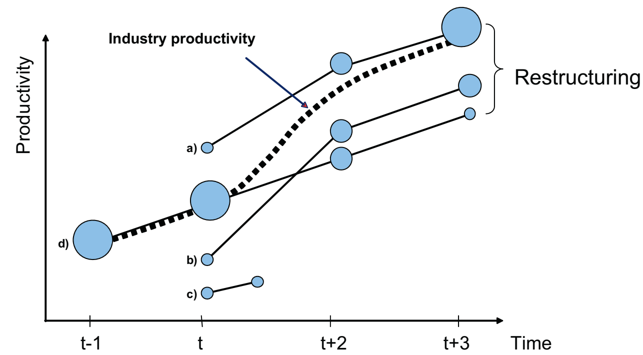

Fig. 1. Sources of aggregate productivity growth.

1.2. Analytical framework and related literature

Fig. 1 illustrates our lifecycle approach. It also allows us to relate our thinking to the four broad branches of the received literature to which we referred above, i.e., to industry life-cycle theory, evolutionary approach to economic development, technology and innovation -based firm entry and growth, and endogenous growth theory.

As Fig. 1 shows, there are three entrants (firms *a*, *b* and *c*), which form an age group and which enter the market at time *t*, and an incumbent (firm *d*), in the industry. The solid lines mirror the productivity development of these four firms over time and the dots their size (i.e., command of resources). An increase in the size of a dot over time mirrors firm growth. The firms constitute an (evolving) industry and the thick dashed line shows its productivity development. The incumbent can be thought as a composite whose productivity development represents the contra-factual of how the industry would develop if there were neither entry nor exit. Depending on how one wants to view it, the figure may thus be seen to present either how an industry evolves over time or how the maturity of an industry leads to an emergence of another, technologically related industry (see also Peltoniemi, 2011, who discuses inter-industry effects in the context of life-cycle theory).

Albeit highly simplified, Fig. 1 is capable of reflecting experimentation, selection, reallocation of resources, and firm-level productivity growth, which – according to the previous literature – are the four key components of industry productivity growth:

Experimentation is about the entry of new firms that have heterogeneous but unknown productivity. Consistent with, e.g., the industry life cycle view (Klepper, 1996, Peltoniemi, 2011) and (Schumpeterian) evolutionary approach (Schumpeter, 1934; Nelson and Winter, 1982; Metcalfe, 1994; Fagerberg, 2003), we can think of the new firms learning the quality of their innovations and/or their productivity (potential) after entry and testing their technology and/or business model in the market (see also Jovanovic, 1982; Dosi, 1988; Brynjolfsson et al., 2008; Gabler and Poschke, 2013). An important consequence of experimentation and entry by heterogeneous firms (i.e., variety; Witt, 1992 and Metcalfe, 1994) is that they can initially lower the aggregate productivity growth: If the *average* productivity of the entrants, such as that of firms *a*, *b* and *c* in Fig. 1, is lower than that of the incumbent(s), the industry's productivity growth rate would have been higher, had none of the firms entered the market.

Selection is a lagged by-product of experimentation and entry: In competitive markets selection is at work when firms with low productivity and/or slow productivity growth, like firm *c* in Fig. 1, are forced to exit. This may reflect, for example, an industry shake-out (in spirit of, e.g., Klepper and Miller, 1995), competition between innovators and imitators or more broadly (Schumpeterian) technological competition (e.g., Winter, 1984; Fagerberg, 1987; Dosi,