

Title: Innovation types and the distribution of turnover growth rates: Preliminary evidence from a short-term firm-level analysis

Keywords: Innovation types, firm growth, generalized additive models

Abstract

Policy makers mostly assume that firm growth is crucially caused by innovative activities. The empirical relationship between firm's R&D expenditure as a measure of innovative efforts and turnover growth as a proxy for firm size has hence been studied extensively. Especially the effect of R&D investments on the tails of the conditional firm growth rate distribution received much attention in the literature (e.g. Coad & Rao, 2008; Kaiser, 2009; Hölzl, 2009; Falk, 2010; Mazucatto & Demirel, 2012; Segerra & Teruel, 2014; Bianchini et al., 2018; Moschella et al., 2019; Guarascio & Tamagni, 2019; Calvino, 2021). Previous research has focused on either fast-growing or shrinking firms since those firms are rather target of economic policy measures than the stable, average ones. Previous research finds that R&D investment is crucial for fast-growing firms and that R&D activities are mostly negatively associated with growth rates of shrinking firms.

The present work examines the non-linear relation between firm growth and different types of R&D activities for different growth rate distribution quantiles in the short term. It improves on previous research by firstly allowing for any functional form of the relation in the empirical quantile model and secondly by disentangling the specific effects of pure product or process innovation in that model. Based on theoretical reasoning and earlier research, our vague hypothesis is that in the short term at least pure process innovation efforts could be positively related to firm growth at the lowest quantiles, even if successful product innovations might be hardly realizable for those firms in poor situations (especially in the short run).

The detailed Community Innovation Survey (CIS) dataset – conducted every two years and provided by EuroStat – allows to investigate the specificities associated with those innovation types. Our CIS sample consists of 14 European firms (Bulgaria, Czechia, Germany, Estonia, Greece, Spain, Croatia, Latvia, Lithuania, Hungary, Malta, Portugal, Romania and Slovakia) operating in any of the CIS documented industries (NACE codes 13–96) covering the period between 2016 and 2018. We apply Quantile Generalized Additive Models (QGAMs; Fasiolo, 2017), which estimate the functional form of the specific partial effects based on *thin plate regression splines* (Wood, 2003). For the estimation, we use Restricted Maximum Likelihood (REML) on Extended log-F models with identity-links (Elf; Fasiolo et al. 2017).

To extract the pure effect of product or process innovation investments, we create subsamples of firms devoting themselves solely to one of these innovation types and we use their annually expenditure in R&D (performed in-house or contracted out to others) as a share of microaggregated real turnover to measure the R&D intensity. (In our analysis, we are not further differentiating between 'innovation types' in terms of impact on the market or technology newness.) Firm growth is measured as the turnover growth rate between the beginning and the end of the observation period. Aside from that, our model includes all control variables suggested by the recent literature.

The preliminary results reveal that for fast-growing firms, product innovation efforts are associated with extensive growth rates in the following two years from a very high intensity

onwards, but the relation reveals to be slightly negative below that intensity. Process innovation, however, does not seem to have any significant relation with short-term growth rates of high-growth firms. On the contrary, we find that process innovation has a significantly positive relation with growth rates of shrinking firms after two years and the functional form of this relation appears to be roughly linear. Finally, our preliminary findings suggest that for shrinking firms, indeed, product innovation efforts are negatively linked to firm growth for nearly all R&D intensities above around 13%. Yet, it is possible that the revealed relationships are different in the long run, although the relation to product innovation has been found to be very similar comparing the short and the medium term (Capasso et al., 2015).