

## Targeting growth and enabling scale: An application of Machine Learning for Growth in Micro, Small and Medium Enterprises in India.

(joint work)

We explore the potential of using machine learning techniques to answer a long-standing policy question in India – how to enable the growth of Micro, Small and Medium Enterprises (MSMEs) in India. The business models of several entrepreneurs interviewed by us and the roadblocks faced by them help us develop a framework for further investigation into the question of growth. We use data from the National Sample Surveys of unincorporated manufacturing enterprises and the Annual Survey of Industries of the organized manufacturing sector for the years 2001, 2006 and 2011. An initial descriptive examination of the data reveals the existence of six distinct kinds of firms – or clusters. We also divide firms into one of four size classes, in line with prior literature, based on the number of paid employees. We balance the data using different techniques. We find, across the prediction algorithms, that there is a significant bias in prediction towards the smaller size classes, even when using the balanced training sets. As an outcome of this observation of downward bias, we formulate the hypothesis that there are firms that should not have been able to grow to the size they are at, given the external conditions and internal business models they adopt. Accordingly, we anticipate that such firms which have grown larger than their “means would support” are highly likely to fail. We estimate the failure rates, growth rates and entry rates in the different size classes from the period 2006 to 2011. We find, as anticipated, that the failure rates faced by firms in the larger size classes are significantly high – suggesting competitive pressure. We also find that the growth rates of firms from the smaller to the larger size classes is insufficient for replenishment required to compensate for failure. The size distribution is maintained by a healthy rate of entry of firms in the larger size classes. An important insight from this is that the fraction of firms in the smaller size classes that are able to grow is limited. The two segments operate as though distinct – with the smaller size classes witnessing lower failure, lower growth and lower entry – essentially a stagnant segment – and the larger size groups indicating a more competitively robust group. We also find from the predictions algorithms that no problem faced by the firms is individually important in predicting the size. However, a counterfactual attempt at estimating the combined impact of solving all problems suggests that a fraction of 10-20% of the smaller size classes are likely to grow to a larger size. A simple calculation estimating the impact of such a scenario shows an increase of almost 50% in the gross value added (GVA). Our analyses provide policy makers with both the evidence necessary to attempt a solution to the problems facing the MSME sector and the tools that can aid them in doing so.