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PRESS RELEASE

Analysis of Business Demography using Markov Chains - An Application to Belgian Data

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This paper analyses demographic evolution of Belgian enterprises using the mathematical theory of Markov chains. The method has the advantage of being able to study not only entries and exits of enterprises, but also migrations of companies between different branches of activity. The so-called migration matrix, containing the number of enterprises switching from one branch to another, gives a fuller picture of demographic changes in a population of enterprises.

The method is illustrated in detail for companies listed in the Belgian Crossroads Bank for Enterprises. This source reflects most the publicly available demographic data from the National Statistical Institute. There are nevertheless some differences because the definition of an 'active' enterprise is not the same. This paper's definition is based on that set out in Eurostat/OECD manuals. Other sources of enterprise data are commented briefly: the population of enterprises used by the National Accounts Institute (NAI) and companies' annual accounts in the Central Balance Sheet Office. The main difference between the NAI and the Crossroads Bank lies in the treatment of enterprises with an 'unknown' activity. The Central Balance Sheet Office has a smaller number of enterprises on its books and is more stable in terms of migrations. It is also less sensitive to the business cycle.

The transition matrix in numbers can be transformed into a migration matrix in percentages by dividing each element by the row total. This matrix shows that firms with an unknown activity code have a significantly higher death rate than other enterprises. This means that enterprises with the 'unknown' activity code tend to have a higher risk to become inactive.

It is argued that this percentage matrix can be seen as the transition matrix of a Markov chain, in other words that the percentages are relatively stable over the period. This stability argument is justified by checking the forecasting performance of the matrix. This forecasting test shows that the average transition matrix can be used to model the demographic evolution over an 'average' business cycle. As such, it can be used to forecast future population developments. Taking into account changes in activity codes leads to better forecasts. For short-term forecasts, it is better to take the business cycle into account and to make the computations with two different transition matrices - one for a period of low growth and one for a period of high growth.

As many forecasts of economic variables use the population structure and its size as an extrapolation factor, the Markov-based forecasts could be used to make better predictions. This is a topic for future research.

The theory of absorbing Markov chains shows that the average transition matrix can also be used to compute average remaining lifetimes and ages of enterprises in a particular branch. This property was applied to the average transition matrix. It shows that the remaining lifetimes and ages can differ considerably across industries. Moreover, short lifetimes combined with an increasing population size are a sign of renewal inside the branch. Relatively new branches of activity tend to have enterprises with a low average age.

Average lifetime and age are therefore useful indicators in the study of innovation and renewal within branches of activity. They yield additional information compared to other indicators like entries and exits that are set out by international methodologies.

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