Mathematics confirm the chaos of the Spanish labor market

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To carry out the study, unemployment figures were provided by Spain's National Employment Institute. Credit: SINC

Unemployment time series in Spain behave in a chaotic way according to a study at the University of Seville. Such chaos demonstrates the complex and unpredictable nature of the Spanish labour market in the long run. However, short term patterns can be predicted using complex mathematical models.

"Using mathematical techniques we have found evidence of chaos in unemployment time series in Spain. In theory, this explains why unemployment trends are so unstable," outlines Elena Olmedo, researcher at the University of Seville and author of the study "Is there chaos in the Spanish labour market?", which was published in the Chaos, Solitons & Fractals journal.

Olmedo explains that when a system is chaotic, its behaviour is "highly complex and unpredictable in the long run". This is the case because any small change is magnified by the system itself. She adds however that "in the short term, its behaviour can be predicted but non-linear models that capture the complexity of behaviour must be used for this."

To carry out the study, Spain's National Employment Institute (INEM) provided the country's unemployment figures over a 36-year period from 1965 to 2001. Through the use of two algorithms, the so-called 'maximum Lyapunov exponent' was calculated. This parameter measures the instability of a certain system. Positive results indicate instability and chaotic behaviour.

The results confirm the nonlinearity and chaoticity of the Spanish labour market. This, in turn, is the first step in characterizing unemployment time series and explaining their reality. Scientists are now working on the second phase of the study. This involves the development of short term predictions with the relevant mathematic models. The Sevillian researchers are currently working with artificial neural networks.

Chaotic models and the 'butterfly effect'

In economics, linear models have been traditionally used to characterise and predict unemployment time series. But, they tend to produce rather simple behavioural trends which have to be randomly disturbed to achieve more realistic results. For this reason the team opted for nonlinear models and concentrated mainly on chaotic models.

These mathematic models are capable of showing very different behaviours over time when dealing with infinitesimally small changes in initial conditions. An example would be the 'butterfly effect' which suggests that the flutter of one of these insects' wings could trigger a tsunami on the other side of the world.

Olmedo concludes that "the use of chaotic models allows us to obtain behavioural trends as complex as their own reality. However, we need to continue in our investigations to find better tools that help us in characterization and prediction."

More information: Elena Olmedo. "Is there chaos in the Spanish labour market?". *Chaos, Solitons & Fractals* 44 (12): 1045-1053, December 2011.

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