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Linking social systems failure of marriages and firms: A short note

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ABSTRACT

This study investigates the failure of social systems and tries to find a plausible mechanism. We observe stretched exponential distributions for failure of marriages in the U.S., UK and Germany and extend evidence for power laws in large firms' failure in the U.S., and worldwide. Since summation of stretched exponentials leads to power laws, one can establish an underlying principle to link different types of social systems failure like marriages and firms. Moreover, we postulate that the generation of these fat-tailed distributions in social systems failure can be explained by the least effort principle of *Zipf* and suggest to increase initial efforts at individual level through marriage counseling, or stakeholder synchronization to reduce failures.

Vinculando el fracaso de sistemas sociales de matrimonios y empresas: una nota breve

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RESUMEN

Este estudio investiga el fracaso de sistemas sociales e intenta encontrales un mecanismo plausible. Observamos distribuciones exponenciales estiradas para matrimonios fracasados en los Estados Unidos, Reino Unido, y Alemania y extender pruebas de las leyes de potencia en el fracaso de grandes empresas en los Estados Unidos y el resto del mundo. Como la suma de exponenciales estirados conduce a las leyes de potencia, se puede establecer un principio subyacente para vincular los diferentes tipos de los fracasos de sistemas sociales como los matrimonios y las empresas. Además, postulamos que la generación de estas

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Divorcio
Leyes de potencia
Distribución exponencial estirada

distribuciones de 'cola gorda' en el fracaso de los sistemas sociales puede ser explicado por el principio del menor esfuerzo de Zipf y sugerir el aumento de esfuerzos iniciales en el nivel individual a través de terapia matrimonial, o sincronización de las partes interesadas para reducir fracasos.

Introduction

Social systems do not last forever (Costanza & Patten, 1995). Whether civilizations, firms, or marriages, their failures have enormous impact on personal and financial stability. Empirical studies have traditionally identified the factors that affect the failure of a social system. However, linking failure patterns across different types of social systems has been a subject of interest for researchers in many disciplines.

Fat-tailed distributions have been empirically observed in numerous natural and social systems, and are most often described in terms of stretched exponentials, log-normals, and power laws. In particular, stretched exponentials have been observed for city sizes (Laherrere & Sornette, 1998); whereas power laws have been identified in human sexual contacts (Liljeros, Edling, Amaral, Stanley, & Åberg, 2001), use of words in languages (Newman, 2005), entry age of marriage (Preston, 1981), as well as for firms regarding their sizes (Axtell, 2001; Gabaix, 2009; Luttmer, 2007), growth (Stanley et al., 1996), and bankruptcy (Fujiwara, 2004; Podobnik, Horvatic, Petersen, Urošević, & Stanley, 2010). Mathematically, a quantity x follows a stretched exponential $A \cdot \exp(-x^{\beta}/\tau)$ by introducing a fractional power law in the exponential function, where β is the stretching exponent ranging between $0 < \beta < 1$, τ and A are scaling parameters. For power laws a quantity y follows probability distributions of $p(y) \propto y^{-\alpha}$, where α is the scaling parameter and normally lies in the range of $1 < \alpha < 2$ for cumulative distribution functions (CDFs).

Based on revealed empirical patterns of failures for marriages and firms, our study suggests the known least effort principle (Zipf, 1949) as a plausible general mechanism to explain failure of social systems. As the size of social systems depends on the number of individuals interacting (Parsons, 1951), we applied extreme case sampling (Patton, 2005) taking both the minimum number of two individuals required to build a social system (two in marriage), and a very large number of individuals (employees in a blue-chip firm). Therefore, we analyze data of more than 650,000 marriages in the U.S., UK, and Germany for the last 25 years, and about 3250 of the largest firms of the U.S. and worldwide for the last 100, 55, and 15 years. We find CDFs of failure times following stretched exponentials with $\beta \approx 0.83$ in case of marriages and power laws with $\alpha \approx 1.5$ for firms. Scale-free power law distributions can result from the summation of fat-tailed distributions by central limit theorem (Stumpf & Porter, 2012; Willinger, Alderson, Doyle, & Li, 2004), which implies that large social systems may fail because of their interacting individuals. Therefore, the best way to reduce the number of divorces and firm failures is to increase the initial efforts of individuals through marriage counseling, or stakeholder synchronization.

The next section presents the material and methods to support our study on failures at marriage (two individuals) level and firm (multiple individuals) level. Subsequently, the results are presented and discussed.

Material and methods

We analyzed failures of the two social systems: marriages and large firms. Marriage data is derived from panel surveys conducted in the U.S., and divorce records of national courts in the UK and Germany. Firm data includes the largest firms of the U.S. and worldwide taken from a stock index and two popular rankings. As shown in Table 1 (Dow Jones IA 30, 2012; Financial Times Global 500, 2012; Fortune 500 Archive, 2012; Marriages Germany, 2013; Marriages UK, 2013; Marriages U.S., 2012), the used data sets cover hundreds of thousands of marriages and thousands of firms across multiple decades. Recent years include marriages and firms with not yet occurred or unknown failure dates, which skew the data toward the right and result in an overrepresentation of young marriages and young firms. Hence estimated failure rates are upper bounds of the real values (Marriages Germany, 2013; Marriages UK, 2013; Marriages U.S., 2012). In addition to this skewness, U.S. census based marriage data is representative in all demographic dimensions (Marriages U.S., 2012), whereas UK and Germany include the entire divorced population (Marriages Germany, 2013; Marriages UK, 2013). Although firm survival data are subject to many factors, such as industry, booms, or recessions, in this paper we neither distinguish their influences nor control for them, but we do look for a pattern in their combined outcome as measured by firm failures. Additional explanations on the methods used for each data set are given in the results section that follows.

Results and discussion

First, to analyze failure distributions for marriages, we looked at frequencies of marriage durations x among all divorces in a given year, normalized by the number of marriages in the corresponding wedding years. By relating each marriage duration to its related marriage cohort, trends like population growth or overall decrease in the number of marriages are equalized. Fig. 1A shows CDFs $P(x)$ for years of marriage at divorce in the U.S., UK, and Germany. Solid lines are best fits to stretched exponential distributions (Laherrere and Sornette, 1998; Podobnik et al., 2010). Average parameter values of high $\hat{\beta} = 0.83$ and low $\hat{\tau} = 4$ imply that the highest divorce frequencies are around 5–8 years, and approach regular exponential distributions ($\beta = \tau = 1$), as shown in Table 2A.

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