

Anti-Parrondo paradox on data transfer

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Abstract

One of the most basic laws in economics are the law of supply and the law of demand [1]. However, real markets quite often behave differently. The most common example of such a situation is the presence of a Giffen good – product whose consumption rises when its price falls and vice versa (violating the law of demand) [2]. The above-mentioned laws indicate that the supply/demand curve is monotonic function of price and their violation results in not monotonic supply/demand function. We consider a simple model of electronic data processing market. Such a type of market seems to be especially interesting because of its progressive automatization (eg. automated forex trading platforms). The used there algorithms should make rational decisions (they are not guided by emotions) – buy low, sell high. Asset-like information has been bought and sold since ancient times [3] but the idea of this type of market is relatively new. Data markets do not have to be global and different groups of its participants may have different knowledge or may use different information theory paradigms (eg. Giffen's paradox). For these reasons, it is possible that data markets are characterized by higher than typical derogations from expectations about the relationship between demand and supply. This can create conditions favouring persistent non-equilibrium of the market. We try to answer the question of "How we should proceed in such circumstances?"

We introduce "Bayesian information market" model. Let $P(s|a)$ and $P(d|a)$ denote, respectively, the probability of purchase and subsequent sale of some piece of information at the price e^a . We define on this market the intensity of worth of information $\rho_t = \frac{E(r_{t,t+\tau})}{E(\tau)}$. It is a measure of decision optimization, where $E(r_{t,t+\tau})$ denotes the expected value of worth of information growth $r_{t,t+\tau}$ for one buying–selling cycle (started at time t) with expected duration $E(\tau)$ (time analysis of an offer). If we assume that the curves $P(s|a)$ (supply) and $1 - P(d|a)$ (demand) are monotonic then the intensity of worth of information has a maximum at its fixed point. This property implies the optimal strategy of buying and selling. However, $P(s|a)$ and $1 - P(d|a)$ are subjective and do not necessarily monotonic (anti-Parrondo paradox [5]). The scope of the applicability of fixed point optimization algorithm in this case will be examined.

There are many types of activities in various networks (searching, data migrations, cloud storage, cloud task processing, traffic flows) which can be considered as a market transactions. In the era of big data analysis their optimization is particularly important.

References

- [1] P. Krugman, R. Wells, "Microeconomics", Third Edition, Worth Publishers, New York, (2013).
- [2] M. Makowski, E. W. Piotrowski, J. Śladkowski, Jacek Syska "The intensity of the random variable intercept in the sector of negative probabilities", arXiv:1503.07495v1.
- [3] J. McGee, L. Prusak, "Managing Information Strategically" John Wiley and Sons, New York, (1993).
- [4] E. W. Piotrowski, J. Śladkowski "A subjective supply-demand model: the maximum Boltzmann/Shannon entropy solution", J. Stat. Mech. 2009, Po3035 (2009).
- [5] L. J. Gunn, F. Chapeau-Blondeau, M. McDonnell, B. Davis, A. Allison and D. Abbott, "Too good to be true: when overwhelming evidence fails to convince", Proceedings of the Royal Society A vol. 472, 20150748 (2016).