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Modeling hedge fund lifetimes: A dependent competing risks framework with latent exit types

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ABSTRACT

Due to the voluntary nature of hedge funds reporting to databases, hedge funds may stop reporting and exit a database not only because of failure, but also as a result of success and reaching the optimal size of assets under management. The existing hedge fund databases do not seem to provide reliable and unambiguous information on the reasons of hedge fund exits. In this paper, we consider that the causes of hedge fund exits are latent, and develop a competing risks model with two exit specific hazard functions, one for each cause of exit. We further allow both exit specific hazard functions to depend on unobserved heterogeneity terms that can be mutually dependent. In this way, we investigate the interdependence between the exit specific hazard functions, and explore their determinants. We show that even without observability on causes of exit, the two sets of coefficients, one for each cause of exit, can be estimated. We find an evidence of strong dependence between the unobserved heterogeneities. We also find that the estimated coefficients of the observed covariates are generally similar whether unobserved heterogeneities or the dependence between them is taken into account or not. However, the estimated exit specific hazard functions are significantly different, due to the standard negative duration dependence in the case of omitted heterogeneity.

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1. Introduction

The hedge fund industry has experienced rapid growth in recent years.[1] At the same time, the number of hedge fund failures has also increased. To the surprise of many, even some high profile hedge funds (such as LTCM, Amaranth and, more recently, the hedge funds owned by Bear Stearns) failed in dramatic fashion, which resulted in substantial losses for investors and pushed the entire world financial system to the brink of a meltdown. The increasing number and severity of hedge fund failures require an efficient method which identifies the factors that affect failure, and predicts the risk of failure. To this end, we apply a duration analysis technique using the TASS database over the period January 1994 to June 2010.

In the hedge fund duration analysis, an important feature that has to be taken into consideration is that hedge funds voluntarily report to databases; thus hedge funds can only be tracked until they stop reporting and, consequently, exit a database. It is well documented in the literature (see e.g., Ackermann et al., 1999; Fung and Hsieh, 2006) that there are two possible reasons for a hedge fund to stop reporting and to exit a database. The first possible reason of exit from a database is success and reaching the optimal size of asset under management (AUM), which leads hedge funds to close to new investors, or to close altogether. The second possible reason of exit from a database is embarrassing losses, failure, or even the prospect of failure. If one does not

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[1] In 2000, there were under 3000 hedge funds managing about US$750 billion in assets, but by June 2010, there were close to 9000 hedge funds managing about US$1.5 trillion in assets (Eurekahedge, 2010).

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differentiate between these two types of exit, and if these exits have different determinants, then this may lead to incorrect inferences. In this paper, we account for the two types of exit event, namely, failure (F) and success (S).

A few studies on hedge fund duration analysis (Baba and Goko, 2006; Rouah, 2005) use the status codes provided by databases to differentiate between the exit types. However, these status codes, which are supposed to explain why hedge funds stopped reporting and exited a database, are either too vague or unreliable.[2] To overcome this difficulty, Liang and Park (2010) suggest that the data on rate of return (ROR) and AUM histories help better distinguish between the exit types. To implement that approach, these authors require a minimum of the last 12 months of RORs and AUMs for each hedge fund, which can potentially create a look-ahead bias. Darolles et al. (2010) propose the use of the status codes and the value of the hedge fund's AUM in the last month to differentiate whether the hedge fund exits due to failure (F) or success (S). The criteria imposed by Darolles et al. (2010) may be insufficient because, in addition to vague or unreliable status codes, the choice of the threshold value for the last month AUM used to disentangle the two exit types (F) and (S), is quite arbitrary and may significantly affect the result.

Since using the status codes provided by a database, and/or using the ROR and AUM histories can be problematic in differentiating between the two exit types, we proceed our analysis with the latent exit types. That is, in contrast to the literature mentioned above, we do not explicitly define which hedge funds exit the database due to (F), and which hedge funds exit the database due to (S). To this end, we consider a competing risks model with two exit specific hazard functions, one for exit type (F) and the other for exit type (S). Furthermore, we allow both of these exit specific hazard functions to depend on exit specific and possibly correlated, unobserved heterogeneity terms.

The first duration model with unobserved heterogeneity was introduced by Cox in, 1955 as the Poisson process with stochastic intensity. That process is also known as the doubly stochastic Poisson or the Cox process. Recently, unobserved heterogeneity has re-appeared in the literature as a component of duration models with non-constant hazard functions and covariates, because of two main advantages that approach can offer. First, in a single duration model, unobserved heterogeneity can eliminate the estimation bias due to omitted covariates. That bias can affect the coefficients on observed covariates as well as the age dependence of the hazard function, which is called the negative duration dependence, or the mover-stayer phenomenon (see e.g., Baker and Melino, 2000; Bretagnolle and Huber-Carol, 1988; Elbers and Ridder, 1982; Heckman and Singer, 1984; Lancaster, 1990). Given the observed covariates, the unobserved heterogeneity may reveal how fragile an individual is. In other words, it reveals if an individual is more or less sensitive to the “death” event than others. This explains why unobserved heterogeneity is also known in the literature under an alternative term “frailty” (see Vaupel et al., 1979). Second, in multiple duration models, unobserved heterogeneity can create a natural link between the various duration processes (see e.g., Flinn and Heckman, 1982; Lindeboom and Van den Berg, 1994). That approach provides a much more flexible representation of the duration dependence than the copula-based approach, for example.

Duration models with unobserved heterogeneity have appeared in the hedge fund literature only very recently. More specifically, Baba and Goko (2006) accounted for unobserved individual heterogeneity in a single risk model. Gregoriou and Pascalau (2012) proposed a joint survival analysis of hedge funds and the funds of hedge funds by introducing dependence between the lifetimes of funds with the same manager. They examined the possible contagion of failures due to the common management. While the methodology was copula-based, it can be interpreted in terms of individual unobserved heterogeneity because it relied on the Archimedean copula.

The unobserved heterogeneity also appears in a stream of literature on hedge fund liquidation clustering that has emerged following the 2008 crisis and the new regulation for Financial Stability. The objective of these papers is to identify common factors that determine the joint probability of hedge fund liquidations. These common factors that reflect the systemic risk in hedge fund markets can be assumed observable. For example, the index return series of stocks and bonds and their volatilities can be interpreted as common factors when the impact of financial markets on hedge funds is considered (see e.g., Billio et al., 2012; Boyson et al., 2010; Carlson and Steinman, 2008; Chan et al., 2007). Alternatively, the common factors can be modeled as dynamic unobserved heterogeneity variables, as for example in Darolles et al. (2011). In that paper, the lifetimes of hedge funds depend on the exogenous frailty effect which is distinguished from the contagion effect on hedge fund markets.

So far, the studies of hedge fund duration model that takes into account different exit types rely on a competing risks framework with the assumption that the potential lifetimes are independent conditional on the observed covariate histories (see Darolles et al., 2010; Rouah, 2005). The assumption of independence is convenient as it makes that analysis significantly simpler. However, it seems to be questionable, because hedge funds with a relatively high conditional probability of exit due to failure may have a lower conditional probability of exit due to success, and vice-versa. This may induce a negative correlation between the lifetimes with exit type (F) and exit type (S). Thus, interdependence between lifetimes with each exit type needs to be modeled, and one way to accommodate this is by introducing unobserved heterogeneity.

We assume that each exit specific hazard function has a mixed proportional hazard specification with exit specific baseline hazard, unobserved heterogeneity term, and covariates. The specific baseline hazard function for each exit type is assumed to follow an expo-power distribution (Saha and Hilton, 1997). The joint distribution of unobserved heterogeneity terms, is supposed to be bivariate discrete with two admissible values for each heterogeneity term. The choice of the bivariate discrete distribution is motivated by the fact that it is flexible, computationally tractable (Van den Berg, 2001) and suitable for segmentation (see the discussion in Wedel et al., 1999). A set of, potentially time varying, covariates are considered as they are expected to affect both probabilities of exit due to failure and exit due to success.

[2] In Subsection 2.3, we discuss in detail why the status codes provided by TASS are either vague or unreliable, and also provide some examples.