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Working Paper No. 0506

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Publisher

Sozialökonomisches Institut
Bibliothek (Working Paper)
Rämistrasse 71
CH-8006 Zürich
Phone: +41-1-634 21 37
Fax: +41-1-634 49 82
URL: www.soi.unizh.ch
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Merge or Fail? The Determinants of Mergers and Bankruptcies in Switzerland, 1995–2000*

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March 1, 2005

Abstract

This paper examines the determinants of mergers and bankruptcies, using firm level data from the Swiss Business Census and the Dun & Bradstreet exit database for Switzerland (1995-2000). Employing duration analysis, we find considerable differences in the determinants of mergers and bankruptcies, in particular with respect to firm size, location and the impact of macroeconomic conditions. Our results support the notion that mergers are often undertaken to seize growth opportunities.

JEL Classification: C41, L10, L20.

Keywords: merger, bankruptcy, failure, survival, exit.

*We are grateful to Daniel Halbheer, Dennis Gärtner and Armin Schmutzler for most helpful comments and suggestions. The usual disclaimer applies.

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1 Introduction

It is commonly accepted that there are essentially three modes of firm exit: (i) bankruptcy, (ii) voluntary liquidation, and (iii) merger. Furthermore, it is fairly natural to view both bankruptcy and voluntary liquidation as varieties of firm failure.[1] The role of mergers, however, is less clear. In a controversial discussion of U.S. antitrust policy, Dewey (1961, 257) stated that "most mergers [...] are merely a civilized alternative to bankruptcy or the voluntary liquidation that transfers assets from falling to rising firms." More recent work suggests, however, that there are important economic differences between mergers and other modes of exit (see, e.g., Peel and Wilson 1989, Schary 1991, Audretsch 1995, Caves 1998, Harhoff et al. 1998, Wheelstock and Wilson 2000). Yet, due to data limitations, empirical studies have rarely been able to make a clear distinction between different exit modes.

In fact, we are aware of only two recent contributions that have explicitly distinguished exit modes. Harhoff et al. (1998) focus on voluntary liquidations and bankruptcies. These authors find that the larger the firm the smaller the probability of *voluntary liquidation*. Interestingly, firm size plays a more subtle role for *bankruptcies*: Here, the authors note that size has a positive marginal effect on the probability of bankruptcy for small firms (less than 18 employees) and a negative effect for larger firms. Wheelock and Wilson (2000) analyze the determinants of *failures* and *acquisitions* in the U.S. banking industry.[2] They find that productive inefficiency increases the risk of failure while reducing the probability of a bank's being acquired.

Related work by Sorensen (2000) has attempted to identify the characteristics of merging U.S. firms using financial data. He finds that mergers are primarily undertaken by firms with above average margins attempting to rapidly increase sales. Andrade et al. (2002, 103), in turn, argue in a recent survey that most of the reasons for mergers provided by economic theory—such as efficiency-related reasons, attempts to increase market power, market discipline, agency costs, or diversification—are "relevant to a comprehensive understanding of what drives acquisitions". This suggests that the principal drivers of mergers and acquisitions are unlikely to be the same as those of bankruptcies or voluntary liquidations. Yet, there is very little evidence on the differences in the determinants of mergers and other modes of firm exit.

[1] Note, however, that the voluntary liquidation of a *venture capital* firm may indicate that its business is expected to be successful after being taken over by a larger established company.

[2] These authors use the terms *acquisitions* and *mergers* interchangeably. In principle, this may be problematic, as the acquisition of a firm is often equivalent to the voluntary liquidation of that same firm, so that the events of failure and acquisition are not necessarily mutually exclusive. We shall use a more narrow definition of mergers below (see section 2).

In the present paper, we attempt to fill part of this gap by analyzing a novel dataset that has only recently become available. This dataset on the exit behavior of firms registered in Switzerland allows us to distinguish different exit modes, in particular mergers and bankruptcies. Employing duration analysis, we find considerable differences in the determinants of mergers and bankruptcies. These concern firm- and industry-specific characteristics as well as the impact of macroeconomic conditions on firm survival. Our findings support the notion that mergers are often undertaken to seize growth opportunities.

The remainder of this paper is structured as follows: Section 2 briefly describes our dataset and the hazard models used for determining the principal drivers of mergers and bankruptcies. Section 3 discusses the results, and section 4 concludes.

2 Data and Models Estimated

To construct our firm level database on the drivers of exit, we merged the following databases: (i) The Swiss Business Census (SBC 95) compiled by the Swiss Federal Statistical Office, which is a full inventory count of all firms with more than 20 weekly aggregate working hours existing in September 1995 (excluding the agricultural sector); (ii) the Dun & Bradstreet Exit database (DBED), which covers the exits of firms listed in the commercial register from January 1994 to December 2000 and distinguishes between bankruptcies, voluntary liquidations, and mergers. It is important to note that—following official administrative practice—a transaction is coded as a *merger* in the DBED if and only if a new firm was founded and *both* former firms were deleted from the commercial register. That is, acquisitions (or "asymmetric" mergers)—where only one of the firms was deleted from the commercial register—are coded as *voluntary liquidations*. As a consequence, the DBED does not allow us to disentangle acquisitions and voluntary liquidations. We therefore focus on the comparison of bankruptcies and mergers, where the latter are narrowly defined as described above.[3]

Our database contained 276,123 firms after excluding all firms that were non-profit oriented according to their legal status (such as cooperatives, associations and clubs, foundations, churches, embassies and international organizations). Since, according to Swiss law, only corporations can take part in a merger transaction, we further eliminated all firms legally classified as partnerships. We also dropped all firms established prior to 1970, since no information on their founding dates was available. After making these adjustments, our sample still includes more than 54,000 corporations, from all industries

[3] In Buehler et al. (2004), we study the determinants of the aggregate of all three exit modes (including voluntary liquidations).

represented in Switzerland (excluding agriculture), in all sizes, and ages up to 25 years. The merged database covers an observation period from October 1995 to December 2000. Table 1 gives the descriptive statistics of the variables used below.[4]

<Table 1 around here>

To model the determinants of mergers and bankruptcies, we first adopt a semi-parametric approach. More specifically, we employ the Cox proportional hazard model with time-varying covariates,

$$h_i(t|\,\mathbf{x}_i(t)) = h_0(t)\exp(\mathbf{x}_i(t)\boldsymbol{\beta}), \tag{1}$$

where h_i is the hazard function of firm i, h_0 is an unspecified "baseline hazard", and $\exp(\mathbf{x}_i(t)\boldsymbol{\beta})$ is the systematic part of the hazard function, with $\mathbf{x}_i(t)$ denoting the row vector of firm i's covariates $x_{ij}, j = 1, ..., p$, and $\boldsymbol{\beta}$ denoting the coefficient vector. This allows us to assess the effect of (changing) covariates on hazard rates without having to impose a particular shape for the baseline hazard (see, e.g., Therneau and Grambsch 2000).

Second, we study a family of parametric models that explicitly specify the baseline hazard h_0 to assess how the hazard function varies over firm age. These (so-called "Accelerated Failure Time") models have in common that the natural logarithm of survival duration, $\ln T_i$, can be expressed as a linear function of the covariates $\mathbf{x}_i(t)$,

$$\ln T_i = \mathbf{x}_i(t)\boldsymbol{\beta} + \epsilon_i, \tag{2}$$

where ϵ_i is the error with a prespecified distribution that determines the regression model. Clearly, the choice of a specific distribution is somewhat arbitrary when the true distribution is unknown. In the next section, we therefore report the estimated hazard functions for various commonly used distributions and discuss to what extent they differ.

3 Results

3.1 Firm Size and Other Determinants

Table 2 presents our results from estimating the Cox proportional hazards model given in (1) for mergers and bankruptcies.[5] To interpret these results, observe that we do

[4] See Buehler et al. (2004) for a more detailed description of the database.

[5] Note that we allow for competing risks in the sense that each firm in the sample (that does not survive) may only either fail or merge. Once it has exited by one of these modes, another type of exit is no longer possible. Due to protection of data privacy, we only know whether (and at which point in time) a firm was involved in a merger; the identity of the other firm(s) involved in the merger remains unknown.

not report the estimated coefficients $\widehat{\beta}_j$ of covariates $x_{ij}, j = 1, ..., p$, but the estimated hazard ratios

$$\widehat{H}_j = \frac{\widehat{h}(t|\, x_j = x_j^0(t) + 1, \mathbf{x}_{-j}(t))}{\widehat{h}(t|\, x_j = x_j^0(t), \mathbf{x}_{-j}(t))} = \exp(\widehat{\beta}_j), \quad j = 1, ..., p,$$

where $\mathbf{x}_{-j}(t) = (x_1(t), ..., x_{j-1}(t), x_{j+1}(t), ..., x_p(t))$. The hazard ratio is the factor by which the hazard function is multiplied if the covariate x_j increases by one unit. That is, if $\widehat{H}_j = 1$, the hazard rate does not change in response to a change in covariate j, whereas the hazard increases (decreases) if $\widehat{H}_j > 1$ ($\widehat{H}_j < 1$, respectively). We now briefly discuss the major differences in the determinants of mergers and bankruptcies.

<Table 2 around here>

Size. For both mergers and bankruptcies, there is an inverted ∪-shaped relation between firm size and hazard rate. Yet, the squared term is significant only for bankruptcies, and the estimated coefficients indicate important differences in the way firm size affects merger and bankruptcy hazards. Figure 1, which plots the total effect of firm size on the hazard for bankruptcy and merger (calculated as the combined hazard ratio of the linear and the quadratic term[6]) against the size of the firm (the number of employees), serves to illustrate this: The impact of firm size on bankruptcy reaches its maximum for very small firms (3 employees) and then decreases monotonically.[7] In marked contrast, the merger probability increases monotonically up to a firm size that is beyond the largest firm in our sample.[8] That is, large firms are less likely to fail than small firms, but they are more likely to merge.

Industry. It is well-known that, depending on product life-cycles, demand shocks, etc., failure rates vary considerably across industries. In this study, we consider the following one-digit industry sectors: (i) manufacturing, (ii) construction, (iii) trade, and (iv) services. We use manufacturing as the reference sector. It is striking that bankruptcy rates are higher in the construction sector than in any other sector. This reflects the "structural crisis" from which this sector suffered during the period of observation.[9]

[6] The combined hazard ratio function is calculated by multiplying the hazard ratios of the linear and the squared size term (from Table 2) for different values of the untransformed number of employees. Note that, together, the linear and squared term are significant, both for mergers and bankruptcies.

[7] Harhoff et al. (1998) find for German data that the hazard function peaks around 18 employees.

[8] The largest firm in our sample has 6,134 employees.

[9] See, e.g., the Historical Dictionary of Switzerland (`http://www.lexhist.ch`). Figures published by the Swiss National Bank (2003) indicate that the price index for apartments fell by more than 23% from 1994-1999; other real estate prices also showed considerable decreases. This is likely to have contributed to high bankruptcy rates, as construction firms often use real estate as collateral to secure credits. A drop in construction expenses of more than 15% from 1994-1999 underlines the problems in this sector.

Interestingly, though, merger rates turn out to be lowest for the construction sector (even though the coefficient is not significant).

Region. Previous work by Kaiser (2004) and Buehler et al. (2004) has established that aggregate exit rates in non-German-speaking areas are generally higher than in German-speaking areas.[10] Our estimation results for bankruptcy rates are in line with this finding. The results for merger rates, however, are reversed: Merger rates are significantly lower in non-German speaking areas, suggesting that there are important differences in the principal drivers of bankruptcies and mergers.

Export orientation. Exporting firms tend to have lower bankruptcy rates than non-exporting firms. More specifically, firms exporting up to a third or more than two thirds of their output have significantly lower bankruptcy rates than non-exporting firms.[11] The picture is less clear for merger rates: None of the hazard ratios is found to be significant, which suggests that a firm's export orientation does have little impact on merger rates.

Macroeconomic conditions. Another important difference concerns the impact of a change in the growth rate of GDP. An increase in growth reduces the probability of bankruptcy, but significantly *increases* the merger probability.[12] This suggests that mergers were not primarily undertaken to avoid business failure. The effects of changes in the Swiss currency's external value and the number of previous bankruptcies on bankruptcy and mergers hazards, however, are fairly similar.

<Figure 1 around here>

Summing up, the results from estimating (1) indicate that there are important differences in the principal drivers of mergers and bankruptcies. In particular, we find that while large firms are less likely to fail than small firms, they are more likely to merge. Furthermore, there are considerable differences in the impact of other covariates—including industry-specific characteristics and relevant macroeconomic conditions—on bankruptcy and merger rates. Taken together, these results indicate that mergers are often undertaken for reasons unrelated to business failure.

[10] Possible explanations for this finding include regional differences in industry composition, tax treatment, unemployment, etc. Future research will examine the regional differences in exit rates in more detail.

[11] Potential explanations include advantages of diversification into different markets and a positive selection of competitive firms operating in international markets.

[12] This result depends to some extent on the time span over which growth rates are calculated. We chose a time span of two years to accommodate (long-term) growth effects. We attempted to control for (short-term) business cycle effects using the number of bankruptcies in the previous year.

3.2 The Effect of Firm Age

In this section, we further explore how bankruptcy and merger rates change over a firm's lifetime. To do so, we use the same covariates as above to estimate a family of models given by (2), making alternative assumptions on the probability distribution of survival duration. More specifically, we employ the four commonly used distributions summarized in Table 3:

<Table 3 around here>

Inspection of Table 3 indicates that the choice of the distribution to some extent determines the shape of the hazard function. The Exponential distribution, for instance, imposes a time-independent hazard rate, whereas the Weibull distribution may give rise to either a monotone increasing or decreasing hazard function. The Log-normal and the Log-logistic distribution, in turn, are able to give rise to hump-shaped hazard functions.[13] We now consider the estimated hazard functions for bankruptcies and mergers for each of these distributions (see Figures 2 and 3).[14]

First, consider the effect of firm age on *bankruptcy*. Figure 2 indicates that the hazard function is essentially decreasing in firm age: Apart from the Exponential model (where the hazard is constant over time by assumption) and the Log-normal model (where an early peak is reached after 9 quarters), estimated hazard functions decrease in firm age. Note, in particular, that the hazard function of the Log-logistic model is monotonically decreasing, even though, in principle, a hump-shaped function would be possible. In terms of both the Log-likelihood and the Akaike information criterion, the Log-normal model performs best, followed by the Log-logistic model.[15]

<Figure 2 around here>

Second, consider the effect of firm age on *merger*. Inspection of Figure 3 shows that the estimated hazard functions look similar to those for bankruptcies, even though the peak of the hazard function from the Log-normal model is reached somewhat later (after 18 quarters). In terms of the Log-likelihood and the Akaike information criterion, we get the same ordering as for bankruptcies, i.e., the Log-normal model performs best, followed by the Log-logistic model.

In sum, we find that the hazard rates for both bankruptcies and mergers tend to decrease with firm age. This is in line with previous literature, which suggests that exit rates decrease with age (see, e.g. Mata and Portugal 1994 and Audretsch et al. 2000).

[13] See, e.g., Kiefer (1988) or Gouriéroux and Jasiak (2003) for a discussion of the properties of these distributions functions.

[14] The regression results are available on request from the authors.

[15] Using the Schwarz criterion does not affect the results.

<Figure 3 around here>

At first sight, it might seem puzzling that a firm's age does affect the likelihood of bankruptcy and merger in very similar ways, whereas the effects of firm size on the likelihood of bankruptcy and merger go in opposite directions. Note, however, that these findings make sense intuitively: They suggest that a small old firm (that has not grown in the past) is unlikely to seek external growth by merger; it is perfectly conceivable, though, that this small old firm merges to avoid bankruptcy. Similarly, a small young firm is unlikely to be ready for an expansive merger. Its decision to merge is more likely to be driven by the wish to avoid early bankruptcy. In contrast, a large old firm (that has grown in the past) tends to seek further external growth by merger. That is, large firms appear to be more likely to undertake mergers to achieve external growth.

In summary, the crucial influence of size (and not age) combined with the possible motive of external growth by merger suggests that firms often merge for reasons unrelated to business failure.

4 Conclusions

The empirical evidence reported in this paper demonstrates that there are important differences in the principal drivers of mergers and bankruptcies. In particular, we find that the standard prediction of the exit literature—large firms tend to have lower hazard rates than small firms—is inappropriate for mergers. In fact, the opposite seems to be true: Large firms are more likely to merge than small firms. A firm's age, in turn, affects the likelihood of bankruptcy and merger in very similar ways: Both bankruptcy and merger rates decrease with age. Taken together, these findings support the notion that mergers are often undertaken to take advantage of opportunities for external growth. More specifically, large firms are more likely to grow further by merger than small firms. Old firms, in turn, tend to merge for the same reasons as they go bankrupt.

The notion that mergers are often undertaken to seize growth opportunities is supported by the other determinants of mergers and bankruptcies. More specifically, merger rates tend to be particularly low in industries and regions where bankruptcy rates are particularly high. Also, merger rates are found to increase with macroeconomic growth, whereas bankruptcy rates decrease.

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Table 1: Descriptive Statistics (source: SBC 95, DBED, SNB, own calculations)

Code	Variable Contents	Mean/Value	Std. Dev./Share
	CARDINAL VARIABLES	Mean	Std. Dev.
	Survival		
Duration	Lifetime of the firm (quarters)	censored/truncated	
	Size		
Emp	Number of employees	13.63	61.36
	Macroeconomic conditions		
GDP Growth	Growth of GDP (1993-1998)	0.83	1.01
Ext Val	Swiss Franc's external value, index (1994-1999)	102.45	4.82
Bankrupt	Number of bankruptcies (per quarter)	45.70	4.78
	CATEGORICAL VARIABLES	Value	Share (%)
	Industry		
Manufact	Manufacturing	Reference var.	18.36
Construct	Construction	0(no), 1(yes)	12.10
Trade	Trade	0(no), 1(yes)	29.63
Service	Service	0(no), 1(yes)	39.90
			$\sum = 100$
	Regions		
Eastern CH	Eastern CH, Zürich and Graubünden	Reference var.	34.11
NW CH	Northwestern CH and Bern	0(no), 1(yes)	23.82
Central CH	Central CH	0(no), 1(yes)	10.66
French CH	French CH	0(no), 1(yes)	24.53
Ticino	Ticino	0(no), 1(yes)	6.87
			$\sum = 100$
	Export Shares		
Exposh 1	no export	Reference var.	73.73
Exposh 2	$< \frac{1}{3}$	0(no), 1(yes)	13.23
Exposh 3	$\left[\frac{1}{3}, \frac{2}{3}\right]$	0(no), 1(yes)	4.62
Exposh 4	$> \frac{2}{3}$	0(no), 1(yes)	8.42
			$\sum = 100$

Table 2: Estimated hazard ratios $(\exp(\widehat{\beta}_j), j = 1, ..., p)$

Covariates	**Bankruptcies**	**Mergers**
Size		
LnEmp	1.1457***	1.5472***
	(0.0528)	(0.1543)
$(LnEmp)^2$	0.9376***	0.9758
	(0.0110)	(0.0176)
Industry		
Construct	1.4095***	0.7663
	(0.0835)	(0.1367)
Trade	0.9033*	1.1907
	(0.0471)	(0.1515)
Services	0.7960***	1.0344
	(0.0402)	(0.1286)
Region		
NW CH	1.1199**	0.8920
	(0.0530)	(0.0987)
Central CH	0.9541	1.0217
	(0.0622)	(0.1443)
French CH	1.3762***	0.5973***
	(0.0614)	(0.0758)
Ticino	1.4152***	0.5928**
	(0.0939)	(0.1280)
Export Orientation		
Exposh 2	0.8168***	0.9732
	(0.0470)	(0.1238)
Exposh 3	1.0637	1.1190
	(0.0865)	(0.2188)
Exposh 4	0.8226***	1.1405
	(0.0561)	(0.1772)

Table continued on next page

Table 2: Estimated hazard ratios (continued)

Covariates	**Bankruptcies**	**Mergers**
Macroeconomic Conditions		
GDP Growth	0.8942***	1.3779***
	(0.0262)	(0.1001)
Ext Val	1.1371***	1.0834***
	(0.0089)	(0.0325)
Bankrupt	1.0011***	1.0020***
	(0.0001)	(0.0003)
Log-likelihood	$-31,724.12$	$-4,708.62$
Number of Subjects	$54,750$	$54,750$
Number of Bankr./Mergers	$3,431$	524

Figures in parentheses are standard errors.

*,**,*** Coefficients are significant at the 10%, 5% and 1% level, respectively.

Dummy Coding of Categorical Variables

Industry: *Manufact* (ref. var.), *Construct*, *Trade*, *Services*;

Region: *Eastern CH* (ref. var.), *NW CH*, *Central CH*, *French CH, Ticino*;

Export: *Exposh 1* (ref. var.), *Exposh 2*, *Exposh 3*, *Exposh 4*.

Table 3: Parametric distributions of survival durations

Distribution	**Density Function**	**Hazard Function**	**Parameterization**
Exponential	$f(t) = \gamma \exp(-\gamma t)$	$h(t) = \gamma$	$\gamma = \exp(-\mathbf{x}\boldsymbol{\beta})$
Weibull	$f(t) = \gamma\alpha t^{\alpha-1} \exp(-\gamma t^{\alpha})$	$h(t) = \gamma\alpha t^{\alpha-1}$	$\gamma = \exp(-\mathbf{x}\boldsymbol{\beta}); \alpha$
Log-logistic	$f(t) = \gamma\alpha t^{\alpha-1}/(1 + t^{\alpha}\gamma)^2$	$h(t) = \gamma\alpha t^{\alpha-1}/(1 + t^{\alpha}\gamma)$	$\gamma = \exp(-\mathbf{x}\boldsymbol{\beta}); \alpha$
Log-normal	$f(t) = \frac{1}{t\sigma}\phi\left(\frac{\ln t-\mu}{\sigma}\right)$	$h(t) = \frac{1}{t}\frac{[1/\sigma\phi((\ln t-\mu)/\sigma)]}{1-\Phi((\ln t-\mu)/\sigma))}$	$\mu = \exp(-\mathbf{x}\boldsymbol{\beta}); \sigma$

ϕ and Φ denote the standard normal density and distribution, respectively.

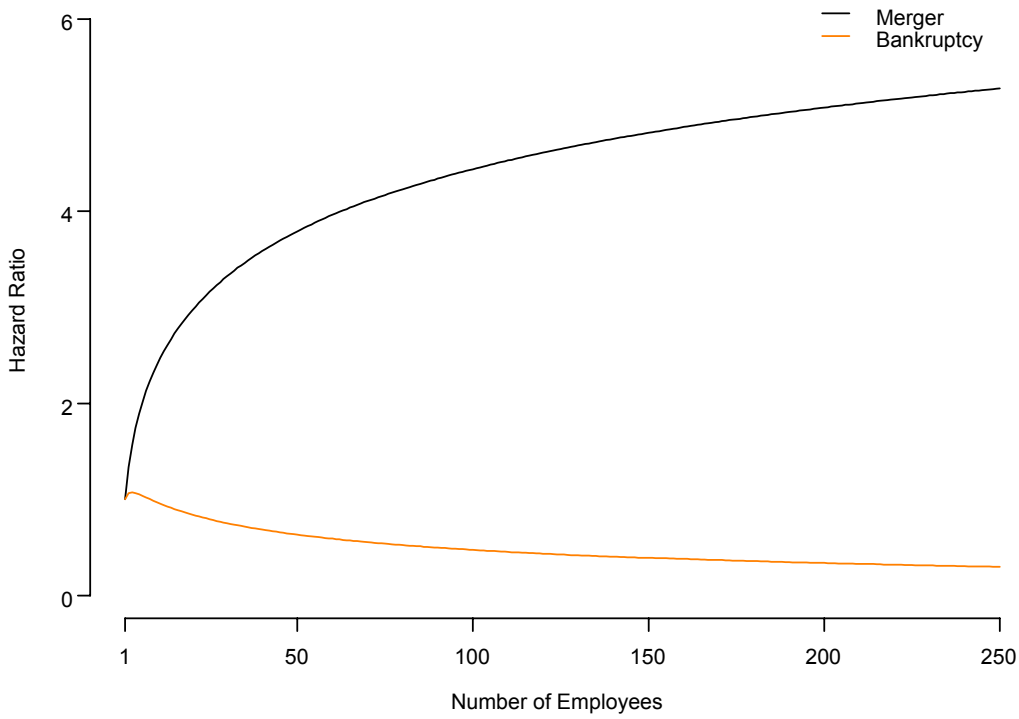

Figure 1: Hazard ratio as a function of firm size

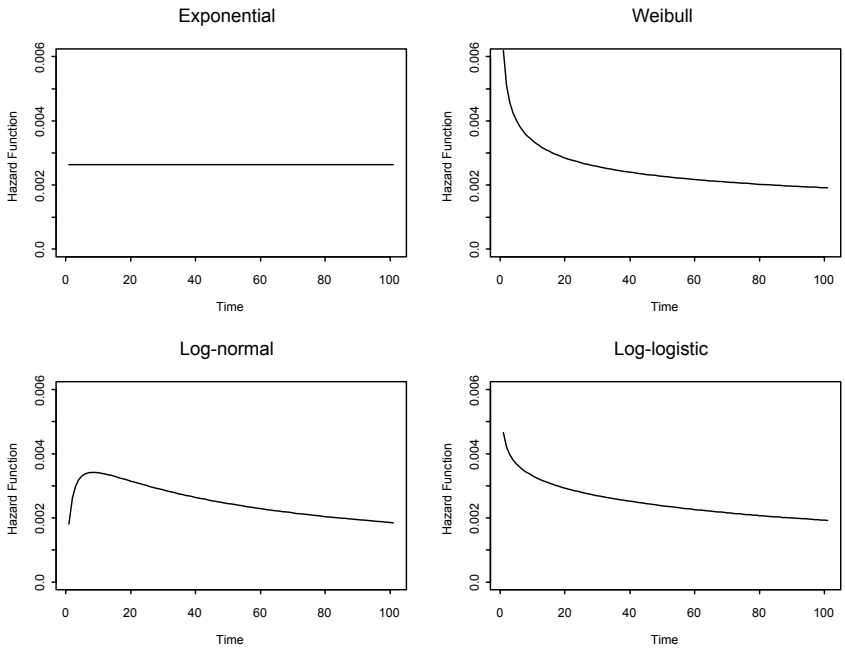

Figure 2: Bankruptcy hazard as a function of firm age

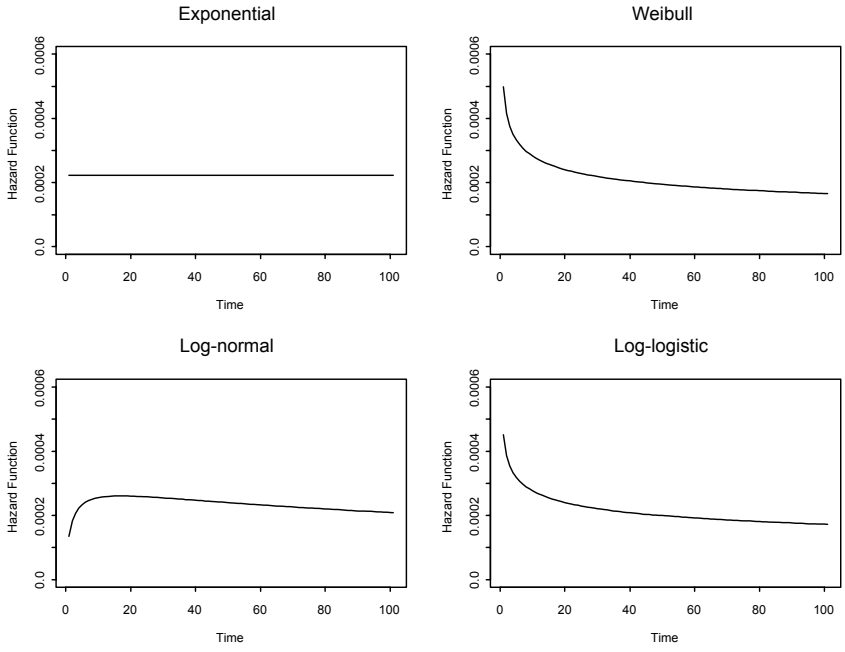

Figure 3: Merger hazard as a function of firm age

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