

Original Research Article

## Analyzing the Impact of Leverage Rate on Export Survival: The Case of Iranian Firms

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One of the goals of the government is to increase the competitiveness of domestic firms to export goods and services. Moreover, the role of exports in many economic sectors has been emphasized. There are two essential requirements for developing non-oil exports: first, the presence of firms in export markets and increasing their competitiveness; second, the survival of them in international markets. This paper assesses the impact of leverage on export survival by using the data of 16 Iranian manufacturing firms from 1999-2018. These companies operate in the agricultural and food industry and are indexed in the stock exchange market. Based on Cox semi-parametric model estimation, the main result is that leverage harms export survival.

**Keywords:** Export survival, Leverage, Firm Heterogeneity, Cox Semi-Parametric Model

**JEL Classification:** G30, G33, F12

### 1 Introduction

One of the goals of macroeconomic policies is to achieve high and sustainable economic growth rates. According to growth theories, the role of firms and households is different in growth. Households provide human capital and labor. Firms are responsible for producing goods and services. Therefore, the role of the firm in production and economic growth is undeniable. International trade can influence economic growth by facilitating the diffusion of knowledge and technology and increasing productivity through the import of high-tech goods. (Zahonogo, 2017).

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Since the firms play a significant role in contributing to economic growth, then by managing their funds efficiently, they can respond to global competition (Eghbalnia et al., 2013). Firms have to pay different fixed costs to participate in the export market. To pay these costs, firms may have financially leveraged their assets. The heterogeneous firm hypothesis was first introduced for a better understanding of the structure of international trade since the 90s, like Bernard & Jensen, 1995, 1999. Differences in the firm's export participation with a combination of fixed costs and firm heterogeneity have been explored in empirical studies.

Financial factors are measured as a heterogeneous factor among firms, which has been the key factor of a firm's survival in the market. So far, scholarly work related to leverage and liquidity across firms has been the subject of much discussion like Greenway et al., (2007). Accordingly, the present paper seeks to survey the impact of financial leverage on export survival in the context of the heterogeneous firm theory. Our analysis is based on a panel of 16 Iranian manufacturing firms over the 1999-2018 period. Our dataset contains financial statements information of companies that are active in the agricultural and food industry of the stock exchange market.

This paper is structured as follows: Section 2 briefly reviews related literature, section 3 describes research pattern and methodology, section 3 introduces the data and then builds an empirical model that generates predictable hypotheses of leverage on export survival, and Section 4 concludes with policy implications.

## **2 Literature Review and Theoretical Background**

Exports provide the opportunity for domestic firms to become familiar with new technology and improve productivity by applying it. Exporters tend to produce more, pay more, and make more profits than other firms (Bernard & Jensen, 1995, 1999). Trade is associated with the reallocation of resources across industries, which increases the average productivity of industries with the emergence of a low-productivity supplier and an increase in the number of high-productivity firms (Pavcnik, 2002). Melitz (2003) showed that differences in firms' export behavior were due to heterogeneity in their productivity. He explained that only higher-productivity firms could earn enough to cover the fixed costs required for exports.

In contrast, lower-productivity firms operate only in the domestic market, and firms with the least productivity are forced out of the market. In this model, for entering into export markets, firms should pay iceberg cost, which is a form of investment and is affected by financial variables. According to Melitz (2003), firms' export decisions cannot be based solely on productivity,

as firms may face financial constraints. Therefore, the financial variables of the firm have attracted the attention of economists.

Chaney (2016) introduces financial constraints into a Melitz-type heterogeneous-firm model. In this model, if firms are required to pay entry cost exporting, only firms without liquidity constraints will be able to enter export markets. Besides, He considers the reliance on internal liquidity as a method to finance international trading activities as information asymmetries between foreign markets can make it difficult to find potential domestic lenders. This pattern shows that with less liquidity, exports will be less.

Muuls (2008) mentions the different ways firms may finance the fixed costs to participate in international trading activities: internal funds such as liquidity, positive exogenous shock, and external financial resources. In this model, the existence of incomplete financial markets leads to low investment in export activities. Export activities have a higher risk because the foreign currency is used, and foreign debt also makes investors or lenders reluctant to help future exporters cover a fixed cost to start exporting. Thus, firms enter international markets when they have higher productivity and lower financial constraints. In particular, financial constraints only affect the decision to join the export market.

The existing empirical literature has been conducted on the relationship between financial leverage and export at the micro-level. However, international trade literature shows that a firm's export activity depends on financial factors such as leverage and credit rationing. In this study, to investigate the effect of financial leverage on firm survival in the export market, Table (1) summarizes the studies conducted in this area.

Table 1  
*A literature review*

Author	Data	Estimation model	Result
Baggs and Brander (2006)	53000 of Canadian and Us companies during 1984-1997	panel	They find that falling domestic tariffs are associated with declining profits, especially for import-competing firms, while falling foreign tariffs are associated with increasing profits. Also, import tariff reductions tend to increase leverage while export tariff reductions tend to decrease leverage.
Bridges and Guariglia (2008)	61,496 UK firms over the period 1997–2002	Survival model	They found that lower collateral and higher leverage result in higher failure probabilities for purely domestic than for globally engaged firms.
Nakhoda (2012)	panel data set from 27 countries (3,600 firms surveyed in 2005 and 3,688 surveyed in 2009)	Probit	He determined that the effect of financial leverage is vary between different trading activities within industries that exhibit different levels of external dependence and asset tangibility.
Bernini, Guillou and Bellone(2015)	French manufacturing exporters over the period 1997–2007	logit	The main result is that there is a negative causal relationship between a firm's leverage and export quality. They studied the direct impact of leverage, but they focus on the quality of exports.
KIM(KILF) (2016)	3353 Korean manufacturing firms over the period 1994– 2011	Pooled Probit	He found that for financially-constrained firms, leverage is negative relation with the probability of exporting and, future exporters have higher leverage before they start exporting.
Silva and Pinto (2019)	7,676 Portuguese SMEs during the 2011-2016 period	Generalized Method of Moments (GMM)	In this paper, they highlight 3 important results: 1. Export intensity negatively affects a firm's leverage level 2. SMEs with a larger growth opportunity set is more levered 3. Profitability, tangibility, and business risk negatively affect SMEs' debt ratios
Maes, Dewaelheyns, Fuss and Hulle (2019)	Belgian small and medium-sized enterprises (SMEs) between 1998 and 2013	propensity score matching	They found that the positive linkage between pledgeable short-term assets and short-term debt financing is more pronounced for exporters.

Studies for Iran are divided into two parts: First, financial studies, which mainly examine the effect of leverage on firm's performance or their bankruptcy for listed companies in the Tehran Stock Exchange like Senbet and Wang (2012) and Abubakar (2017). Second is international trade, which studies the impact of productivity on export as heterogeneous firms hypothesis like Rasekhi and Mojdeh (2013). As we described above, financial factors are one of the important elements for firms to choose a market, and thus leverage

reflects the firm's financial situation. In this paper, we try to study the effect of financial leverage on export survival in firm-level data and consider financial leverage as one of the heterogeneous factors.

### 3 Estimation Methodology

Survival analysis is the analysis of statistical breakdown data that its purpose is to estimate the time (T) up to the moment of occurrence of a specific event. Then, this variable is analyzed by the survival function and the hazard function. Medical research was the first use of survival analysis. Survival analysis involves the modeling of time to event data; in this context, death or failure is considered an "event" in the survival analysis literature. Survival data analysis is performed in three ways: parametric, semi-parametric, and fragility models. One of the common models for analyzing survival data is the Cox proportional hazards model (Aghaeepour & Karraee, 2015).

In this study, exit from the export market is our target event in this research. If the interval is  $[0, \tau]$  are studied. There are three situations: first, the firm will exit the export market before the end of the period. In this case, the export duration T is known. Subsequent cases are situations where the firm has been out of the export market before or after the timeframe.

This model is based on the basic hazard function and explanatory variables,

$$h(t|x_i) = h_0(t) \exp(x_i\beta_x) \quad (1)$$

Where  $x_i$  is the vector of variables factor,  $\beta$  is a vector of regression coefficients,  $h(t|x_i)$  is the hazard calculated for each individual  $i$  and  $h_0(t)$  is the basic hazard function. The ratio of the hazard function is named the hazard ratio. Cox proportional-hazard model is a semi-parametric method that enables to determine the effect of different variables on the hazard. The proportional hazards assumption can be checked with the help of partial (Schönfeld) residuals, and also, the equality of survivor functions across two or more groups can be checked with the log-rank test. If the proportional hazard assumption is violated, then we shall build a Cox model with non-proportional hazard by entering an interaction between the specific covariate and time (Borucka & Poland, 2014).

## 4 Data and Summary Statistics

### 4.1 The Database

The dataset was collected from financial statements of 16 Food and Agricultural Companies in the Tehran Stock Exchange during 1999-2018. For this study, all companies have the following characteristics: 1. Their income does not result from the ownership of other companies; 2. Their financial year ends at the end of year 3. The information required exists during the period.

Our database contained financial information, but not all data were available over the period under reviews, such as research and development costs, so the information available to the paper was used to fit the heterogeneous firms' hypothesis. The definition of variables used in this article is as follows:

- Ln (Leverage): Natural logarithm of the firm's debt to current assets.
- Ln (size): Natural logarithm of Total assets
- Ln (wage): Natural logarithm of wages
- Firms are divided into three 21-year periods by age (by year of establishment). Some firms are born during the survey, and others were established before 1999. So the age is different from 0 to 66, and so we divided the age of firms into 3 periods.

### 4.2 Summary Statistics

Log-Rank test is the most appropriate when the hazard functions are thought to be proportional across the groups if they are not equal. This test is for showing the equality of survivor functions for our sample. According to Table (2), the null hypothesis that the survival functions are identical is not rejected, so the data studied in this study are disproportionate.

Table 2

#### *Log-Rank Test*

ageG	Events observed	Events expected
0	4	2.75
1	7	8.36
2	3	2.89
Total	14	14
chi2(2)		2.4
Pr>chi2		0.3013

Source: Authors' estimations.

According to Table (3), which shows the results of the Cox semi-parametric model, the firm's age and size have a positive effect on decreasing the probability of exiting from the export market, and this effect is statistically significant. As we described in section (2), in many studies, leverage has an important role in firms' self-select into the export market (Greenaway et al., 2007; Silva, 2011). The financial leverage increases the probability of an exit from the export market by 0,98percent. Exporters should pay for marketing, advertising, and improving goods for trade, so without enough cash, and they tend to exit from the market. By taking anti-logarithm, this coefficient reaches 2.68 or the hazard ratio, which differs only in reporting and not in the results. It can be analyzed that with less debt and more assets helps a firm to survive in the export market (Haeng-Sun, 2016). Also, the wage was effective on export according to previous studies (Rasekhi & Mojdeh, 2013).

Table 3  
*Estimation Result*

_t	Coef.	P>z	Haz. Ratio	[95% Conf.	Interval]
Ln(leverage)	0.986487	0	2.681797	1.957512	3.67407
Ln(wage)	-0.58551	0	0.556824	0.455375	0.680875
Ln(size)	- 0.6791	0	0.507072	0.43601	0.589716
Age G					
[23 41]	-0.47408	0.059	0.622455	0.380674	1.017803
[42 59]	-0.94103	0.005	0.390224	0.203019	0.750053

Source: Authors' estimations. According to the cox model with Stata 15, the coefficients are written in column (1) and standard deviation in column (2). Firms are age-divided (based on year of establishment) into two 3 periods. Hazard rates are written in column (3) is the result of taking the logarithm of the estimated coefficients of column (1). Columns (4) and (5) are the upper and lower limits of the estimated hazard.

One way to check for proportionality of hazards is to use the Schoenfeld residuals. In table (4) variable by-variable overall test using the Schoenfeld residuals is mentioned. The test yields no evidence against the proportional hazards assumption; it means that the hazard ratio does not depend on time. We could get a hint of the nature of the time dependence by plotting the residuals against time and using a smoother to glean the trend, as shown in curve (1).

Table 4  
*Schoenfeld Residuals*

	rho	chi2	df	Prob>chi2
lnleverage	-0.05249	0.03	1	0.865
lnwage	-0.23073	1.14	1	0.2855
lnsize	0.20902	0.65	1	0.4215
0b.ageG	.	.	1	.
1.ageG	0.18794	0.73	1	0.3932
2.ageG	0.09958	0.2	1	0.6555
global test		1.16	5	0.9487

Source: Authors' estimations with Stata 15

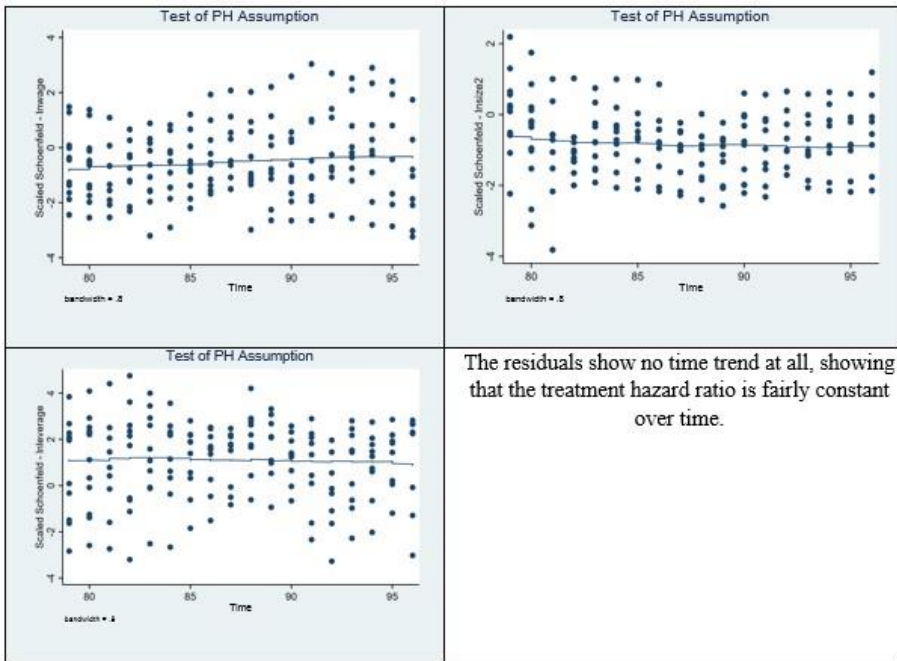


Figure 1. Test of PH Assumption.

Source: Authors' estimations.

## 5 Conclusions

By introducing the heterogeneous hypothesis of firms, Melitz (2003) attributed the differences in firms' export behavior to their productivity differences. He showed that only higher-productivity firms were able to



generate sufficient profits to cover the fixed costs required for exports. In contrast, lower-productivity firms only operated in the domestic market. According to studies conducted by Melitz, firms' export decisions cannot be based solely on productivity considerations. Therefore, the financial resources, as one of the factors of heterogeneity among firms, have attracted the attention of economists.

In this paper, we have introduced a new element of firm heterogeneity to understand why some firms survive in the export market while others stop exporting. This study has used a panel of 16 Iranian firms over the period 1999-2018 to analyze the role played by leverage in determining firms' survival. According to the Cox (1972) model, financial leverage increases the probability of an exit from the export market. Other variables, i.e., size, wage, and age, have a negative coefficient. It means that they decrease the probability of exiting from the export market.

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