Survival Strategies under Sanctions: Firm-Level Evidence from Iran

Iman Cheratian, Saleh Goltabar, Mohammad Reza Farzanegan

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Abstract

Given the importance of firm strategic management in time of crises, this study investigates Micro, Small, and Medium Enterprises (MSMEs) survival strategies during the international sanctions against Iran. Using data from a questionnaire of 486 firms between December 2019 to September 2020, we found that firm strategies in reducing research and development (R&D) expenditures, marketing costs, and fixed/overhead costs and investing in information technology (IT) are positively related to their survivability. Conversely, managerial decisions to "reduce production" and "staff pay cut/freeze" have negative and significant impacts on a firm's ability to survive during sanctions. Moreover, micro firms are more resilient than their small and medium counterparts. The findings also confirm that age has a significant and positive impact on firm survival. Finally, the results show that having a business plan, access to finance and technology, owner education, export orientation, business networking and consulting services are the key drivers of withstanding the pressure from sanctions.

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1. Introduction

 "Do Sanctions Work?" There is persuasive evidence that economic sanctions can significantly damage economic growth, disrupt trading activities and hurt welfare in a sanctioned country (Jacobson, 2008; Neuenkirch and Neumeier, 2015; Gharibnavaz and Waschik, 2018; Farzanegan and Hayo, 2019). In response to multilateral economic sanctions, a sanctioned country establishes a range of resistant, aggressive and impermanent policies aimed at mitigating hardships on the economy. In addition, economic firms are also affected by sanctions and adopt survival strategies to escape the grip of sanctions, reduce economic pressures, and to protect their profitability.

The main purpose of this study is to investigate firms' survival strategies during the international economic sanctions against Iran. Hence, the question behind this study is: What operational strategies do Micro, Small, and Medium Enterprises (MSMEs) use during sanctions to increase their chances of survival? At the firm level, the goal is to minimize economic losses and increase resilience during sanctions. MSMEs may have advantages such as flexibility, learning capabilities, innovation, and customer relations, but due to resource constraints, weaker market positioning, and other factors, they may be highly vulnerable to crisis events (Herbane, 2010).

The Iranian economy has experienced ongoing political and economic sanctions by the United States since Iran's 1979 Islamic revolution. In early 2012, due to the Iranian nuclear program, the European Union and the United States imposed broad economic and energy sanctions against Iran (Cheratian et al., 2019). As Figure 1 shows, following the multilateral sanctions on transactions with Iran's Central Bank and the significant reduction in Iran's oil sales in 2012, the GDP growth rate decreased to -7.44% and the Ease of Doing Business ranking was downgraded to 152 (out of 190) in 2012. In 2018, the United States' withdrawal from the Joint Comprehensive Plan of Action (JCPOA) restored all sanctions to include Iran's financial and energy sectors. Afterwards, the GDP growth rate collapsed from 13.39% in 2016 to -6.02% and -6.78% in 2018 and 2019, respectively (blue colors in Figure 1). Thus, it can be found that international sanctions as a soft option may harm the Iranian economy like a war and cause significant collateral damage to the business environment and economic welfare. In the Ease of Doing Business ranking released by the World Bank (2020), Iran is 178th, which was the worst ranking in the recent decade. Therefore, the issue for firms is no longer the effects of sanctions but the strategies to manage them.

Figure 1 Trend of annual GDP growth rate and ease of doing business (2008–2020)
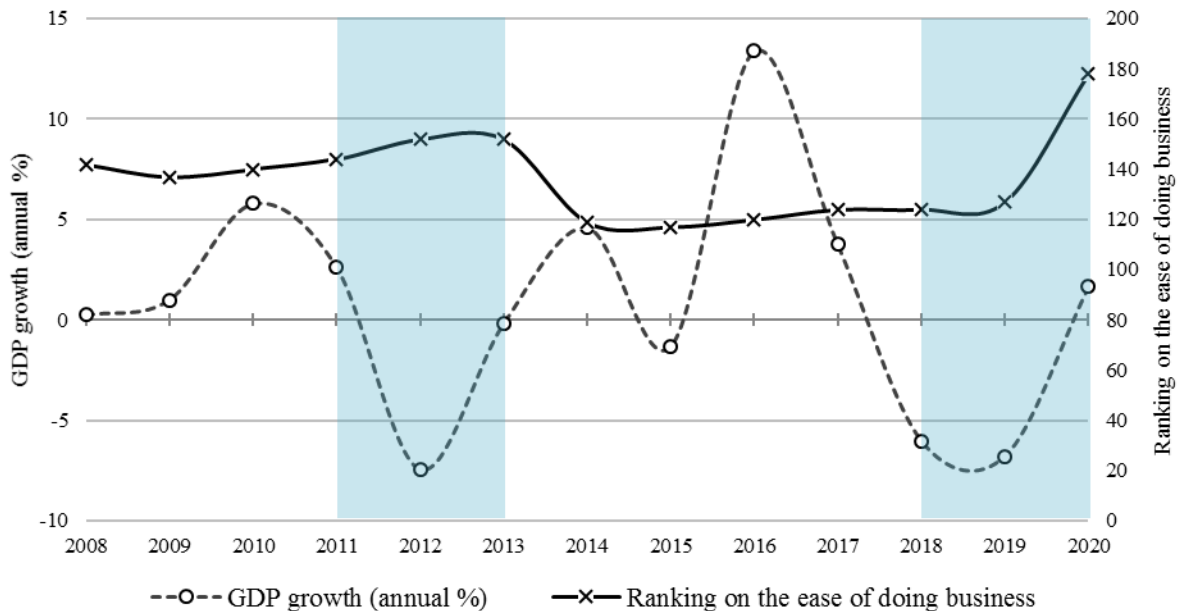
The main contribution of this study is to use a unique data set in empirical analysis that was constructed from our survey study at the Academic Center for Education, Culture, and Research (ACECR) at Tarbiat Modares University (Tehran, Iran), which included a wide range of questions on different areas related to MSMEs. The survey project was also supported by Iran's Plan & Budget Organization. The subsequent and core theoretical contribution of our study is to investigate and shed light on the effects of sanctions from the perspective of a sanctioned country. To our knowledge, this is the first study that evaluates counter-sanctions strategies, particularly for MSMEs.

Our findings suggest that firms can increase their chances of survival during economic sanctions through "*reduce (or cut) marketing costs*", "*cut R&D expenditures*", "*invest in IT*" and "*reduce fixed costs/overhead costs*" approaches. In contrast, the approaches of "*reduce production*" and "*staff pay cut/freeze*" can bring challenges that threaten the firm survivability. Moreover, micro firms are more resilient in crisis because of their very low scale with limited funds, limited raw materials, own sale outlets, and local markets. Survival probability decreases with SMEs, which require more equipment, tools, and materials. Also, the findings confirm that firm age has a significant and positive impact on survival as older firms have more experience and capacities during economic hardships. Finally, the study shows that having a business plan, access to finance and technology, owner education, export orientation, access to business networking and consulting services are the key drivers of firms to withstand pressure from sanction.

The study proceeds as follows: Section 2 reviews the theory and related literature. We explain the data in Section 3. Section 4 presents the methodology. We explain the empirical results and discussion in Sections 5 and 6, respectively. Section 7 concludes.

2. SMEs in time of crisis: theory and evidence

2.1. Theory

During a crisis, firms are considered to adopt efficient strategies to promote their organizational capacity and survive until the post-crisis recovery period. Apart from the source of financing, firms' investment propensity tends to decrease in recession periods (Geroski and Gregg, 1997). Demand uncertainty makes firms' investment behavior riskier than during periods of prosperity. Economic uncertainty also reduces banks' willingness to finance firms' investment projects. In this situation, smaller firms face more difficulties in financing than larger firms because of credit rationing by financial intermediaries (Arvanitis and Loukis, 2020). While many previous studies have focused on the role of a firm's characteristics, such as size (Varum and Rocha, 2012), age (Cefis and Marsili, 2005), access to finance (Carbo-Valverde et al., 2016), exporting (Lee et al. 2012), ownership education (Jarmin et al. 2014), networking (Cainelli et al., 2019) and location (Ramalho et al., 2018), this section reviews the common survival strategies implemented by many firms in response to the negative effects of economic turbulences.

The firm's optimal reaction to a negative external shock is widely related to the nature, duration, and depth of the shock, the firm's special characteristics in time of shock, and the firm's product and labor market environments. A sharp reduction in demand usually leads to both production and price cuts, which depend on the degree of stickiness in prices and wages. If prices are sticky, firms are more likely to cut their production and margin in response to the shock in demand. In this situation, the extent of production and margin cuts are mostly dependent on the elasticity of demand, the firm's monopolistic market power and the firm's ability to cut costs. During an economic crisis, firms are affected from both a reduction in demand and a credit crunch. Generally, credit constraints intensify cost-cutting strategies, however, the effect on production and price is ambiguous. Firms which tend to maximize profits, are unlikely to cut the production or prices in response to a sharp decline in external financial resources. In facing a credit constraint, some firms are more likely to pressure internal and external costs in order to mitigate the cash flow limitations. The optimal cost-cutting strategy mainly dependent on the intensity and duration of the shock, as well as product and labor market constraints (Fabiani et al., 2015).

In terms of human resource management (HRM), only a few studies have investigated SMEs and large enterprises HRM practices during crises. In the area of HRM strategy, firms may decide to reduce the size of their labor force through a combination of conducting layoffs, freezing wages and cutting benefits. However, as mentioned by Rones (1981), "the firm ability and willingness to use layoffs is in determination of redundancy related benefit." Regarding the large number of employees and more complex internal labor markets, large enterprises may identify more reasons to make labor force reductions. Furthermore, resource restrictions accompanied by operating in

labor-intensive businesses provides SMEs more incentives to retain their employees and avoid extra recruitment costs by adopting alternative retrenchment strategies (Lai et al., 2016).

During economic hardships, some firms use pay cuts or freezes as an alternative strategy to laying off employees. This strategy can help business owners to avoid losing skilled labor and save costs for re-recruitment for the post-crisis recovery period (Lai et al., 2016). Comin et al. (2009) indicate that firms that have experienced instability in profitability and sales are more likely to pass along some of the turbulences to their employees, especially those with higher labor costs. However, using pay cuts strategy can be a problematic approach for entrepreneurs. As the Bewley (2021) indicates during economic recessions, employees' earnings may maintain downward rigidity, despite owners' resistance to pay cuts. A clear explanation of this phenomenon is related to the theory of wage rigidity developed by Solow (1979) and Akerlof (1982). Many firms (except those which experienced serious challenges in recessions) do not prefer a pay cut system as an alternative to layoffs, because cutting wages may lead to morale damage across the labor forces with negative effects on work effort and ethic and the need for more supervision (Bewley, 2021).

To manage the negative effects of crises, some SMEs reduce R&D investment as a common strategy to manage short-term challenges (Jung et al., 2018). However, some SMEs prefer to increase their innovative activities to establish competitive advantages for the post-recessionary periods (O'Malley et al., 2011). There are some SMEs which implement a hybrid of the mentioned strategies (Archibugi et al., 2013). A firm's decision to choose an optimal approach highly depends on their characteristics (size, age, environment, etc.). Current evidence reveals that fast-growing, young SMEs are more likely to invest in R&D investment, whereas larger firms tend to increase efficiency through decreasing R&D investment (Latham, 2009).

Similar to cutting R&D investment strategy during recessions, many firms follow the strategy of decreasing spending on marketing (Greenberg, 1993). This can be a common strategy to save limited resources and survive until the post-crisis recovery period (Srinivasan et al., 2005). Marketing investment has a cyclical behavior in many firms, with increasing trend during prosperous times and decreasing during hardships (Tubbs, 2007). Marketing is considered as an expense for many organizations and so a large percentage of marketing budgets are reduced during turbulences (O'Malley et al., 2011).

To reduce the costs of economic crisis, investment in information and communications technology (ICT) may be a potential driver of firm resilience. Firms using ICT may be able to overcome the negative shocks of economic crises by reorganizing production processes easier, which can result in higher productivity and competitiveness. Firms which prolong the adoption of new technologies may face the risk of exiting the market (Bertschek et al., 2019). Along these lines, Pérez-Estébanez et al. (2018) indicate that despite a crisis, European firms consider ICT as a key component to their strategy. Furthermore, small firms tend to improve their usage of ICT compared to large firms.

2.2. Evidence

The nature and extent of the effects of crises on SMEs have become a central topic of empirical studies in recent years. Most studies mainly discuss the origins of crises and their impact on economies, industries, and in particular, entrepreneurs. There is a common belief that SMEs are the most vulnerable sector during economic crises (Latham, 2009). Due to their limited financial resources, high dependency on bank loans and paying high interest rates, SMEs may suffer performance disruptions during prolonged economic crises. In addition to financial dependency, SMEs usually face relative shortcomings in terms of managerial, human capital, market position, and technological capabilities that may affect them negatively during crises (Marino et al., 2008). Unlike large firms, SMEs rely more on (fewer) customers, suppliers (Nugent and Yhee, 2002), and markets (Narjoko and Hill, 2007), which may increase the risk of failure and reduce their capacity to overcome economic hardship.

Despite these shortcomings, SMEs have some special characteristics that may help them during economic downturns. When threats or opportunities arise, SMEs may be more flexible in adjusting processes, resource inputs, products, and prices (Reid, 2007) and are more likely to pursue growth-oriented strategies (Latham, 2009). During economic downturns, SMEs are less resistant to inertia, rigidity, and sunk costs (Tan and See, 2004) and also rely less on formal credits, compared to large enterprises which are burdened by more debts (Ter Wengel and Rodrigez, 2006). Because of their smaller size, SME decision makers are closer to their customers and other stockholders who can provide them valuable market information in reacting to crises (Eggers et al. 2012).

In order to shed more light on the effects of crises on SMEs, Appendix (1) shows the relevant studies divided by geographical scope, time period, type of crisis (with focus on economic and financial sectors), methodology, and main findings. As the results show, most studies cover the impacts of the 2007-2008 global financial crisis on SMEs performance, focusing on European countries. However, some studies have focused on developing economies (see Marino et al., 2008). In this area, a series of studies have investigated changes in the financial indicators of SMEs (profitability, leverage, debt ratio, liquidity, and asset structure) in response to the crisis (see De' Amato 2019; Yazdanfar et al. 2019; Bussoli and Marino 2018; Kim et al. 2015). Some other studies have investigated the difference of such financial indicators between old and young SMEs (see Serrasqueiro et al., 2018) or SMEs and their large counterparts (Kudlyak and Sanchez, 2017).

In the field of strategic management, several studies have indicated the role of entrepreneurial orientation (EO) and market orientation (MO) during economic downturns. Regarding this, SMEs with a EO viewpoint may have benefited from innovativeness, proactiveness and consequently, the willingness to take risks which may help them to have better chances of survivability during and after a crisis (Covin and Lumpkin, 2011). Related studies also show the positive effects of MO and a combination of EO and MO on SMEs performance during times of crisis (Beliaeva et al., 2020).

Crises may not just be due to economic or financial hazards, natural and environmental disasters may also affect entrepreneurial activities. Regarding the current evidence, natural crises substantially damages the process of entrepreneurial activities and make it difficult for entrepreneurs to return to their normal operations (Grube and Storr, 2018). Therefore, due to the large scale of production networks, firms' productivity may diminish in the aftermath of a crisis (Carvalho et al., 2021). Since 2019, significant attention is given to the COVID-19 pandemic and its effects on SMEs survival (Brown and Cowling, 2021), SMEs access to finance (Brown et al., 2020), SMEs strategic management (Castro et al., 2020), SMEs formation (Haltiwanger, 2021) and public policy initiatives (Groenewegen et al., 2021).

Review of the current literature shows that previous studies have mainly focused on the financial aspects of European SMEs during the 2007-08 global financial crisis with less attention devoted to the SMEs in developing economies. Over last two years, a new strand of studies has discussed the impacts of the COVID-19 crisis on SMEs and how it will change the way of life and work. However, to the best of our knowledge, there is lack of studies on the effects of international sanctions on the SMEs sector in sanctioned countries. In a rare study in this area, Haidar (2017) uses a unique firm-level dataset to investigate the effects of international sanctions against business exports over the period of January 2006 to June 2011. His results show that sanctions against Iran (in 2008) led to export deflection in two-thirds of exporting firms to non-sanctioning countries. This effect was heterogeneous and mainly depends on exporter characteristics (such as firm size, type of product, and destination country). He concludes that if the goal of international sanctions is to reduce aggregate exports, they may not be effective in a globalized economy where export deflection is possible.

In the case of Iran, there are several studies on how international sanctions influence the total economy (Gharibnavaz and Waschik, 2018), household welfare (Khabbazan and Farzanegan 2016; Farzanegan et al. 2016), government expenditures and revenues (Dizaji, 2014; Farzanegan, 2011), military spending (Farzanegan, 2021; Dizaji and Farzanegan, 2020), shadow economy (Farzanegan and Fischer 2021; Farzanegan and Hayo 2019; Farzanegan, 2013), trade openness and political institutions (Dizaji, 2019), export (Shirazi et al. 2016), firm entry (Cheratian et al. 2021) and black market premiums (Zamani et al. 2021). However, the case of survival strategies of SMEs under sanctions, which in 2020 is amplified by the COVID-19 pandemic, has not been investigated for Iran yet. Our study aims to fill this gap in the literature and provide the first empirical evidence on the characteristics which influence the survival of firms under sanctions in Iran.

3. Data

3.1. Sample

The data for this study is collected through surveys conducted from December 2019 to September 2020 by the Academic Center for Education, Culture, and Research (ACECR) by using in-person questionnaire.[1] This survey covers information for Micro, Small and Medium enterprises (firms between 1-49 employees) in Iran when the U.S. withdrew from the JCPOA and sanctions returned with greater intensity in 2018. To do so, 486 MSMEs from 5 provinces in Iran have been identified as a sample. In selecting the provinces, in addition to the geographical distribution, the level of development in the provinces are also taken into account so that that two provinces with higher levels of development (Tehran and Razavi), two provinces with medium levels of development (Mazandaran and Kerman) and one province with a lower level of development (Ilam) are selected from the 5 geographical regions (North, South, East, West and Center).

Owners and senior managers of business enterprises were interviewed as a unit of observation and the number of sample firms in each province was weighted to take into account unequal probabilities of selection in the survey. The survey covers a vast range of topics related to micro, small, and medium enterprises. The themes include intra-organizational goals and values, financing, business environment, sanctions, survive and marketing, education and skills, job creation and labor adjustment, government laws and administrative bureaucracy, export and competitiveness, computers, internet and websites, networking and business consulting and information. For conducting interviews and completing questionnaires, the interviewers were faced with COVID-19 restrictions and public closures so each firm was only visited once and the interviews were conducted just with the employer or manager of the firm in order to generate a robust questionnaire. The key characteristics of the collected survey are listed in Table 1.

Table 1 Survey of technical data

	Tehran	Mazandaran	Ilam	Kerman	Razavi	Total
Firms*	5576	1850	259	1780	2621	12086
Sampling	159	99	29	100	99	486
Size						
Micro (1-9)	65	31	15	34	50	195
Small and Medium (10-49)	94	68	14	66	49	291
Age						
Less than 5 years old	22	27	8	27	21	115
6-10 years old	41	29	9	30	22	131
11 years old and more	86	43	12	43	56	240

Note: total registered firms in each province*

3.2. Dependent Variable

Panel A of Table 2 shows the definition of the dependent variables, which capture the effects of sanctions on businesses. The firm's managers were asked to specify: "How have sanctions affected your business?" The response variable has three categories: "It has caused a boom", "It has caused a recession" and "It has been ineffective".

3.3. Explanatory variables

Independent variables in this study can be classified into survival strategies and firm and location characteristics. Due to the importance of survival strategies, the data were recorded on a Likert scale, ranging from zero being "very low" to four being "very high". The survival strategies respectively consist of: "*Reduce (or cut) marketing costs*", "*Cut R&D expenditures*", "*Invest in IT*", "*Reduce fixed costs/overhead costs*", "*Reduce production*", "*Reduce the number of employees*" and "*Staff pay cut/freeze*".

The firm and location characteristics are included in the model to control for the possible contextual effect. The firm characteristics include size, age, business plan, demand for finance, access to technology, owner education, export orientation, business networking and demand for consulting services. Firm size is measured by employment numbers that are divided in two groups. Firm age is reported in three categories, including less than 5 years old, 6-10 years old, and 11 years old and more. Variables on the business plan, demand for finance, access to technology, owner education, export orientation, business networking and demand for consulting services are defined as binary variables, 1 if the answer to the question is a 'yes', 0 otherwise.

The business plan indicator measures the credit support for the firm's application. Demand for finance is defined as to whether the firm owners reported having applied for financing for their businesses in the previous twelve months. In addition, access of firms to required technology or infrastructures have been included. Owner education is an indicator for the formal educational qualification, measured if the owner has a university degree or higher. The export orientation variable indicates if the firm exports its products to international markets. The proxy of business networking provides information about cross-firm convergence and their link to business networks. Finally, we include demand for consulting services to see if professional firm managers have used consulting services in the past twelve months.[2] We use five location characteristics: Tehran, Mazandaran, Ilam, Kerman and Razavi. About 33% of firms are in Tehran, 20% each in Mazandaran, Kerman and Razavi, and about 7% of the sample firms are located in Ilam. The overall sample size is 486.

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[2] For more details, see Panel B of Table 2.

3.4. Descriptive statistics

Table 2 reports the descriptive statistics of the dependent and independent variables. The mean of effects of sanctions on firms is 1.04, which means that the sanctions caused a recession for most of the enterprises. Amongst survival strategies, "Reduce fixed costs/overhead costs" has the highest mean value about 2.19 that means reducing fixed costs and/or overhead costs is the most important strategy for the firms to survive during the sanctions. In contrast, the survival strategy of "Staff pay cut/freeze" has the least importance in the face of sanctions, from the firm's perspective, about 1.06.

Table 2 Descriptive statistics

Name	Explanation	Mean	Std. Dev.	Min.	Max.
Panel A: **Dependent variable**					
Effects of sanctions on firm	0 - It has caused a boom; 1 - It has caused a recession; and 2 - It has been ineffective	1.04	0.49	0	2
Panel B: **Independent variable** Survival strategies					
Reduce (or cut) marketing costs	0 - very low; 1 - low; 2 - medium; 3 - high; and 4 - very high	1.60	1.27	0	4
Cut R&D expenditures	0 - very low; 1 - low; 2 - medium; 3 - high; and 4 - very high	1.65	1.25	0	4
Invest in IT	0 - very low; 1 - low; 2 - medium; 3 - high; and 4 - very high	1.47	1.27	0	4
Reduce fixed costs/overhead costs	0 - very low; 1 - low; 2 - medium; 3 - high; and 4 - very high	2.19	1.34	0	4
Reduce production	0 - very low; 1 - low; 2 - medium; 3 - high; and 4 - very high	1.68	1.37	0	4
Reduce the number of employees	0 - very low; 1 - low; 2 - medium; 3 - high; and 4 - very high	1.55	1.33	0	4
Staff pay cut/freeze	0 - very low; 1 - low; 2 - medium; 3 - high; and 4 - very high	1.06	1.19	0	4
Firm characteristics					
Size - Micro	1 - if number of firm's employees between 1 to 9; 0 - otherwise	0.40	0.49	0	1
Size - Small and Medium	1 - if number of firm's employees between 10 to 49; 0 - otherwise	0.54	0.49	0	1
Age - Less than 5 years old	1 - if age of firm less than five years old; 0 - otherwise	0.23	0.42	0	1
Age - 6-10 years old	1 - if age of firm between six to ten years old; 0 - otherwise	0.23	0.42	0	1
Age - 11 years old and more	1 - if age of firm eleven years old and more; 0 - otherwise	0.49	0.50	0	1

Business plan	1 - if firm have a business plan; 0 - otherwise	0.65	0.47	0	1
Apply for finance	1 - if firm applying finance in the past 12 months; 0 - otherwise	0.41	0.49	0	1
Access to technology	1 - if firm access to required technology or infrastructures; 0 - otherwise	0.65	0.47	0	1
Owner Education	1 - if the business owner has university degree; 0 - otherwise	0.65	0.47	0	1
Export Orientation	1 - if firm has export to international markets; 0 - otherwise	0.19	0.39	0	1
Business networking	1 - if firm linked to business networks; 0 - otherwise	0.60	0.48	0	1
Access to consulting services	1 - if firm applying consulting services in the past 12 months; 0 - otherwise	0.50	0.50	0	1
Location characteristics					
Tehran	1 - if firm is located in Tehran province; 0 - otherwise	0.32	0.46	0	1
Mazandaran	1 - if firm is located in Mazandaran province; 0 - otherwise	0.20	0.40	0	1
Ilam	1 - if firm is located in Ilam province; 0 - otherwise	0.05	0.23	0	1
Kerman	1 - if firm is located in Kerman province; 0 - otherwise	0.20	0.40	0	1
Razavi	1 - if firm is located in Razavi khorasan province; 0 - otherwise	0.20	0.40	0	1

4. Methodology

The primary objective of this study is to investigate the managerial decision-making process to survive during sanctions. We use weighted ordered probit estimations. An ordered probit model is applied to estimate the relationships between an ordinal dependent variable and our independent variables. Given that the dependent variable is an ordered categorical variable, ordered probit is a more appropriate econometric method than linear regression since it does not impose the assumption that all adjacent responses are equidistant (Long and Long, 1997). The ordered probit models are relevant in such an analysis insofar as they help to analyze the ranking of the scaled dependent variable sanction effects. The usage of a weighted ordered probit model exploits the ranking information included in the scaled dependent variable of the effects of sanctions. Weights are assigned based on firm two-digit International Standard Industrial Classification (ISIC) industry codes. Weights are proportional to the inverse of the probability of being sampled. In fact, the usage of weights enables us to obtain representative results without the influence of a specific industry with large sample size (Tomohara and Ohno, 2013).

We use a weighted ordered probit model where *s** is an unobserved latent variable of sanction effects to firm *S*, and *x* is expressed as a linear combination of factors that affect *s**, together with

an error term, ε, which is independent of x and has the standard normal distribution as $s^* = x\beta + \varepsilon$. The firm's managers were asked to specify: "How have sanctions affected your business?". Responses are given in three-point scale from level "0. It has caused a boom", "1. It has caused a recession" to "2. It has been ineffective".

The probability of s is expressed as follow:

$$P\left(s = j \mid x = F(\varphi_j - x\beta) - F(\varphi_{j-1} - x\beta)\right) \qquad , j=0,1,2 \qquad (1)$$

where F is the cumulative distribution function of ε and an observation for the sanction effects is defined as s=j if $\varphi_{j-1} < s^*\varphi_j$ and $\varphi_0 = -\infty$ and $\varphi_2 = +\infty$ (Tomohara and Ohno, 2013).

However, as in the ordered probit estimation, the equation has a nonlinear form and only the sign of the coefficient can be directly interpreted and not its size. Calculating the marginal effects is therefore a method to find the quantitative effect of each independent variable on the probability of the sanctions' effects (Brown et al., 2009).

In order to provide a better interpretation of the ordered probit coefficients, marginal effects are estimated. Suppose that there are three categories as our dependent variable, the responding extent of the marginal effects from every independent variable could be presented as Greene (2012) shows:

$$\partial Prob(y = 0)/\partial x = -\varphi(x'\beta)\beta$$

$$\partial Prob(y = 1)/\partial x = [\varphi(-x'\beta) - \varphi(\mu - x'\beta)]\beta \qquad (2)$$

$$\partial Prob(y = 2) / \partial x = \varphi(\mu - x'\beta)\beta$$

Where μ is an estimated threshold parameter and φ is the standard normal density. The β coefficient measured to identify the importance of each of the independent variables on the probability of sanction effects. Notice that the sum of the marginal effects equals zero, therefore the signs on the marginal effects do not remain constant. One unit increase in the independent variable (x), shifts the distribution slightly to the right and if we assume that β is positive, $Prob(y = 0|x.\beta.\mu)$ will decline. It means that $Prob$ (y=0: sanction cause a boom) has the opposite sign of β at the lowest ordered level. In contrast, the signs of β for $Prob$ (y=2: Sanctions has been ineffective) at the highest ordered level remains unchanged. Greene (2012) illustrated that for the middle events probability, we need to examine the signs. Thus, the signs of β for $Prob$ (y=1: Sanctions cause a recession) are ambiguous.

5. Empirical results

The results on the relationship between a firm's survival strategies and the effectiveness of sanctions are shown in Table 3. Since the sanction effectiveness is reported as an ordinal variable, an ordered probit model is adopted and in order to provide a better interpretation of the obtained

coefficients, the marginal effect for "sanctions has been ineffective" (outcome 2) is presented, which explains the probability of the ineffectiveness of sanctions. Initially, it should be noted that when the dependent variable is ordered, the estimated parameters do not reflect a unit change of an independent variable on probability; thus, the estimated coefficients in an ordered probit have no direct interpretation. The information in Table 3 is organized into three columns. As a further robustness check, we replicate our estimates using weighted least squares regression that can be seen in the first column of Table 3. The last column contains the marginal effects on the probabilities that sanctions have been ineffective for changes in the independent variables. According to Greene (2012), the signs of the marginal effects do not remain constant and sum of the coefficients is equal to zero, but we can compare the effects quantitatively by looking at the marginal effects. Thus, we use the main marginal effect (outcome 2) of the estimated variables to discuss the results in this section. Panel A of Table 3 reports the detailed distribution of our measures of firm survival strategies. As shown, the model is significant and all the parameters of strategies except for "reduce the number of employees" are significant. The coefficients for four of the seven strategies are positive and two are negative. The weighted ordered probit regression from testing the log likelihood was -8963.55 and the χ^2 was 1095.36, with the model significance level at p=0.000.

Inspection of Table 3 indicates that the coefficient for the strategy of "Reduce (or cut) marketing costs" is significant and positive at the 1% level. That means that the strategy has a positive impact on the firm's survival during the sanctions and as marketing costs decrease by one point, the probability of the ineffectiveness of sanctions and/or surviving during sanctions is expected to increase by about 0.8 percentage point (pp). Also, the results associated with "Cut R&D expenditures" indicate that the marginal effect is statistically significant and positive, but the magnitude of effect is small. This means that as "Cut R&D expenditures" increases by one point, the probability of firm survival against sanctions is expected to increase by about 0.4 pp. Moreover, as "Invest in IT" increases by one point, the probability of the ineffectiveness of sanctions is expected to increase by 0.5 pp. The results in Table 3 indicate that the last and largest positive coefficient for the strategies is related to "Reduce fixed costs/overhead costs"; as "Reduce fixed costs/overhead costs" reduce by one point, the probability of firm survival during sanctions is expected to increase 1.7 pp.

Additionally, the results for firm survival strategies during the sanctions showed that the signs of the coefficients of "Reduce production" and "Staff pay cut/freeze" strategies are negative and statistically significant, and are respectively, about -0.8 and -3.2 pp. The coefficients confirm that as "Staff pay cut/freeze" increases by one point, the probability of firm survival is expected to drop 3.2 pp; the probability of firm survival is expected to drop 0.8 pp as production reduces by one point.

Table 3 Estimation results

Explanatory variable	Weighted Least Square		Weighted Ordered Probit		Marginal effects
	β	Std. Error	β	Std. Error	dy/dx (percentage point)
Panel A: Survival strategies					
Reduce (or cut) marketing costs	0.015 ***	(0.003)	0.038 ***	(0.009)	0.8 ***
Cut R&D expenditures	0.007 **	(0.003)	0.021 **	(0.009)	0.4 **
Invest in IT	0.008 **	(0.003)	0.025 ***	(0.009)	0.5 ***
Reduce fixed costs/overhead costs	0.032 ***	(0.003)	0.081 ***	(0.009)	1.7 ***
Reduce production	-0.015 ***	(0.004)	-0.037 ***	(0.011)	-0.8 ***
Reduce the number of employees	-0.003	(0.004)	-0.004	(0.011)	-0.0
Staff pay cut/freeze	-0.058 ***	(0.004)	-0.148 ***	(0.011)	-3.2 ***
Panel B: Firm characteristics					
Size - Micro	0.126 ***	(0.022)	0.311 ***	(0.056)	7.1 ***
Size - Small and Medium	-0.043 **	(0.020)	-0.120 **	(0.053)	-2.6 **
Age - Less than 5 years old	-0.046 *	(0.025)	-0.108 *	(0.065)	-2.3 *
Age - 6-10 years old	0.103 ***	(0.025)	0.274 ***	(0.064)	6.4 ***
Age - 11 years old and more	0.061 **	(0.024)	0.169 ***	(0.062)	3.7 ***
Business plan	0.035 ***	(0.010)	0.090 ***	(0.025)	1.9 ***
Apply for finance	0.127 ***	(0.009)	0.321 ***	(0.024)	7.3 ***
Access to technology	0.024 **	(0.009)	0.065 ***	(0.024)	1.4 ***
Owner Education	0.034 ***	(0.010)	0.083 ***	(0.027)	1.8 ***
Export Orientation	0.063 ***	(0.011)	0.159 ***	(0.028)	3.6 ***
Business networking	0.023 **	(0.009)	0.053 **	(0.024)	1.1 ***
Demand for consulting services	0.079 ***	(0.009)	0.200 ***	(0.023)	4.4 ***
Panel C: Location characteristics					
Tehran	0.756 ***	(0.035)	-0.215 ***	(0.033)	-4.5 ***
Mazandaran	0.747 ***	(0.038)	-0.242 ***	(0.038)	-4.9 ***
Ilam	0.649 ***	(0.041)	-0.499 ***	(0.055)	-8.5 ***
Kerman	0.817 ***	(0.037)	-0.063 *	(0.036)	-1.3 *
Kh.Razavi	0.841 ***	(0.036)	-	-	-
Number of observations	12655		486		
LL test			-8963.55		
LR chi2			1095.36		
Prob > chi2			(0.000)		
Pseudo R^2			0.057		
R^2	0.824				
F-statistics	2470.64				
Prob. > F	(0.000)				
Weights	2-digit ISIC		2-digit ISIC		

Note: (a) *** $p<0.01$, ** $p<0.05$ and * $p<0.1$. (b) "-"means omitted because of collinearity. (c) the marginal effects are for the probability of "*Sanctions has been ineffective*".

Panel B of Table 3 illustrates the results after controlling for various firm characteristics. The results of the weighted ordered probit model confirm that the coefficients of size and age are significant and vary for different sub-categories, whereas the signs of the coefficients of business plan, apply for finance, access to technology, owner education, export orientation, business networking, and access to consulting services variables are positive and statistically significant at the 1% level. Marginal effects on the binary variables are shown as well. A firm that applied for finance and accessed to loans will increase the probability of the ineffectiveness of sanctions by 7.3 pp, and a firm that uses consulting services will increase the probability of survival by 4.4 pp. A complete set of calculations of these values is available upon request. Panel C of Table 3 defines the additional control variables regarding the location of firms. Here we use five province indicators but have no explanatory power for them as they are found to be negative and significant.

6. Discussion

In terms of how firms can survive under sanctions, we find that even during a recession, there are some strategies that many firms follow to counter the sanctions. The most important strategy for firms during sanctions is not to freeze or reduce staff pay. Our result is in line with the findings of Bewley (2021) that pay cuts were not preferred by many firms as nominal wage cuts damage morale across the workforce and may raise labor monitoring costs, reduce labor efficiency, and firm productivity. The second most important survival strategy for firms under the sanctions is reducing fixed and overhead costs. This suggests that the "Reduction of fixed costs/overhead costs" can positively influence the degree of scale economies in a firm, which is an important factor in survivability (Audretsch, 1995). Moreover, smaller firms have the advantage of low overhead costs and can improve their cost efficiency during the recession period by controlling overhead costs (Mahmood, 2000).

Our analysis shows that firms should reduce their marketing costs to survive. Indeed, for many firms, marketing and advertising expenditures are considered as marginal expenses (Danaher and Rust, 1994) that are negatively affected by the crisis (Navarro, 2009) and reducing them may enhance the firm's short-term earnings. According to our results, decreasing production is another strategy that firms should avoid. The results imply that a decrease in firm production during a crisis would entail a loss of competitiveness and market share and consequently, negatively impact the firm's cash flow and future production (Argyres et al., 2019). Hence, reducing production is a threat to the firm's survival and weakens the firm's capabilities during sanctions. Consistent with Ravichandran et al. (2005), the results provide some support for the use of IT capabilities, helping firms in terms of flexibility and adaptability. Moreover, it is beneficial for the sustainable competitive advantage, which leads to firm survival and success. Finally, according to Behboudi et al. (2013), the average share of R&D expenditures in GDP in Iran during the recent years was below 1 percent. This suggests that economies with natural resource abundance, such as Iran, are labor-intensive in their industries, especially for MSMEs. The larger exporting enterprises are more productive, skilled, and capital intensive in Iran (Rasekhi et al. 2019), but MSMEs are focused on local markets and are not export-oriented, as the share of R&D was about 0.2 % in the

manufacture's value-added (Farjadi et al. 2018). Therefore, MSMEs are less suffering for cutting R&D expenditures. Hence, the least important strategy that can help the firms to survive during sanctions is cutting R&D expenditures.

We employed various specifications of the size and age variables. There is a strong size and age effect in that smaller and older firms are more resilient during periods of economic hardship. The positive and significant coefficient of micro firms suggests that they are more localized businesses that sought lower amounts of external finance, have very limited exporting activities (Cowling et al., 2021), and are more resilient than larger firms. Also, the measured coefficients for the older groups of firms (6 years old and more) have the same sign and significance as above. Most of the difference between older and younger firms is their experience during economic hardships. Chang et al. (2002) argue that older firms may benefit from their greater business experience than their younger counterparts, which reflects the impact of the accumulated learning-by-doing. Thus, older firms in Iran, through experimentation, learned how to withstand sanctions.

Moreover, our findings reinforce the evidence that firm characteristics are effective factors during the sanctions. In Table 3, firms that had business plans are more likely to resisting the negative effects of the sanctions. The existence of a business plan has a large impact on the rate of business start-ups, survival of existing firms, employment, profits, and sales of firms (McKenzie, 2017). On the other hand, managerial decisions to apply for finance and the firm's ability to access finance have a strictly positive and significant effect on a firm's survival during sanctions that is in line with Cowling et al. (2016). Also, we find evidence that access to technology improves firm performance in terms of resistance against the negative influences of the sanctions. It has been accepted that accessing and utilizing technology can create a sustainable competitive advantage for firms (Sakas et al., 2014). The results for owner education indicate that there is a significant and positive association between owner's level of education and the success of MSMEs during the crisis. This finding is consistent with the study of Doms et al. (2010), where owner education is positively correlated with a variety of outcomes used to measure firm performance. Also, higher educated business owners are more likely to employ an educated local labor force, which might help firms to be more successful.

We found that export orientation is a highly positive and significant determinant of firm survival during the period of crisis in Iran. The main sales by Iranian MSMEs are at local market and the export destinations of the few exporting firms are to neighboring countries like Iraq, Syria, and Afghanistan. Moreover, economic sanctions will cause Iran's national currency, the rial, to depreciate (Ghorbani Dastgerdi et al., 2018). This depreciation decreases the price of exported goods and increases the price of imported goods so export-oriented industries will benefit. Narjoko and Hill (2007) investigate firm survival during the 1997/1998 Indonesian crisis and find export orientation to be a highly significant determinant of both survival and recovery. In line with prior research (Hite and Hesterly, 2001), Table 3 documents that business networking is beneficial for MSMEs in Iran during the imposed sanctions. A firm's network can be an important source of knowledge and competitive advantage (Dyer and Singh, 1998) that increases the firm's chance of

survival (Schoonjans et al., 2013). In addition, SMEs can benefit from economies of scale without having the disadvantages of being large-scaled (Watson, 2007). In terms of access to consulting services, we find that consulting had a positive and significant impact on the ability of MSMEs to withstand economic sanctions. Bruhn et al. (2018) noted that consulting intervention had a positive impact on the productivity of enterprises and could help cope better with the 2008 economic crisis. Firms that are less well trained might experience economic shocks more passively and do not have the tools to counteract a shortfall in demand.

7. Conclusion and policy recommendations

This research explores how Micro, Small, and Medium Enterprises (MSMEs) in Iran have functioned in a sanctioned economy. The "maximum pressure" campaign by the Donald Trump administration from 2018-2020 was aimed to change the political behavior of the Iranian government by increasing economic burdens. There is a growing number of studies which have looked at macroeconomic indicators under sanctions. However, how the firms at the micro level react to sanctions and which factors are responsible for their survival is an unexplored field in Iran. Our study addresses this gap in literature. Using a novel dataset based on a survey of a large number of MSMEs regarding their strategies in response to the 2019 and 2020 sanctions and employing ordered probit regression, we shed more light on the dynamics of business under sanctions in Iran. The findings show that under survival strategies, reducing marketing, fixed/overhead, and R&D costs and investment in information technology increase the survival of firms under sanctions. In other words, these strategies show relevant effects in making the sanctions ineffective. However, strategies such as reducing production levels and cutting/freezing staff pay reduce the survival of firms. They do not help firms to become resilient against sanctions. Firm characteristics with positive impacts on survival likelihood are having a business plan, access to finance and technology, owner education, export orientation, and access to business networking. Finally, our results show that micro firms are more resistance against the negative effects of the sanctions.

Interesting policy implications can be drawn from the results. As the extensive discussion shows, policymakers can implement policies to support domestic production by applying lower advertising tariffs for domestic businesses in the media (newspapers and television). Moreover, business managers may have strong incentives to opportunistically cut R&D expenditures in order to save more costs. Our view, however, is that authorities can encourage businesses to invest in IT and provide low-cost services in this area like "Empowerment System" in the Ministry of Communications and Information Technology of Iran that has been launched to provide bank loans for a maximum period of 30 days with low interest rates and a one-year delay for loan repayment. In particular, the evidence gathered in our study suggest businesses to take an integrated approach to reduce fixed and overhead costs. This can be achieved by receiving discounts on employee insurance costs and premiums paid to social security and pension organizations. In addition, the reduction of union fees and tax rates as well as increasing energy and raw material efficiency can help a lot in this regard.

Furthermore, we argue that supportive policies could be implemented to stabilize production and remove its barriers so that firms do not reduce their production during sanctions. One of the challenges for MSMEs is the lack of working capital and access to financing, which diversification of financing methods and accurate identification of production priorities can address them. Another obstacle to production in Iran is the multiplicity of laws in the industrial sector and it is necessary to amend laws in this area. In addition, incentive policies can be implemented for firms that retain their workforce and do not freeze the pay. For example, the insurance company can pay the unpaid wages of the labor instead of the employer within a certain period. Also, allocating bank loans to firms that did not lay off workers would be a particularly useful policy in this area, which was implemented during the COVID-19 pandemic in Iran. Policies like these make businesses prioritize regular payroll and labor retention. In the above-mentioned analysis, it should be noted that according to the results, these proposed strategies should be more carefully and sensitively implemented in small and medium enterprises, as well as young enterprises, because this group of enterprises is more vulnerable to pressures under sanctions.

References

Akerlof, G. A. (1982). Labor contracts as partial gift exchange. *The Quarterly Journal of Economics*, 97(4), 543-569.

Archibugi, D., Filippetti, A., & Frenz, M. (2013). Economic crisis and innovation: is destruction prevailing over accumulation?. *Research Policy*, 42(2), 303-314.

Argyres, N., Mahoney, J. T., & Nickerson, J. (2019). Strategic responses to shocks: Comparative adjustment costs, transaction costs, and opportunity costs. *Strategic Management Journal*, 40(3), 357-376.

Arvanitis, S., & Loukis, E. (2020). Reduction of ICT investment due to the 2008 economic crisis and ICT-enabled innovation performance of firms. *Journal of the Knowledge Economy*, 11(1), 1-27.

Audretsch, D. B., (1995). *Innovation and Industry Evolution*, Cambridge, Mass.: MIT Press.

Barron, A., Hultén, P., & Hudson, S. (2012). The financial crisis and the gathering of political intelligence: A cross-country comparison of SMEs in France, Sweden and the UK. *International Small Business Journal*, 30(4), 345-366.

Behboudi, D., Assadzadeh, A., & Oskoui, K. N. (2013). Knowledge economy and regional development in Middle East countries. *International Journal of Economics and Finance Studies*, 5(2), 152-163.

Beliaeva, T., Shirokova, G., Wales, W., & Gafforova, E. (2020). Benefiting from economic crisis? Strategic orientation effects, trade-offs, and configurations with resource availability on SME performance. *International Entrepreneurship and Management Journal*, 16(1), 165-194.

Bertschek, I., Polder, M., & Schulte, P. (2019). ICT and resilience in times of crisis: evidence from cross-country micro moments data. *Economics of Innovation and New Technology*, 28(8), 759-774.

Bewley, T. F. (2021). *Why wages don't fall during a recession*. Harvard university press.

Brown, R. C., & Cowling, M. (2021). The geographical impact of the Covid-19 crisis for pre-cautionary savings, firm survival and jobs: evidence from the UK's 100 largest towns and cities. *International Small Business Journal*, 39(4), 319-329.

Brown, R., Rocha, A., & Cowling, M. (2020). Financing entrepreneurship in times of crisis: Exploring the impact of COVID-19 on the market for entrepreneurial finance in the United Kingdom. *International Small Business Journal*, 38(5), 380-390.

Brown, S., Garino, G., & Martin, C. (2009). Firm performance and labor turnover: Evidence from the 2004 workplace employee relations survey. *Economic Modelling*, 26(3), 689-695.

Bruhn, M., Karlan, D. S., & Schoar, A. (2018). The impact of consulting services on small and medium enterprises: Evidence from a randomized trial in Mexico. *Journal of Political Economy,* 126, 635–687.

Bussoli, C., & Marino, F. (2018). Trade credit in times of crisis: evidence from European SMEs. *Journal of Small Business and Enterprise Development*, 25(2), 277-293.

Cainelli, G., Giannini, V., & Iacobucci, D. (2019). Agglomeration, networking and the Great Recession. *Regional Studies*, 53(7), 951-962.

Carbo-Valverde, S., Rodriguez-Fernandez, F., & Udell, G. F. (2016). Trade credit, the financial crisis, and SME access to finance. *Journal of Money, Credit and Banking*, 48(1), 113-143.

Carvalho, V. M., Nirei, M., Saito, Y. U., & Tahbaz-Salehi, A. (2021). Supply chain disruptions: Evidence from the great east japan earthquake. *The Quarterly Journal of Economics*, 136(2), 1255-1321.

Castellani, D. (2018). Mortgage-backed Securitization and SME Lending During the Financial and Economic Crisis: Evidence from the Italian Cooperative Banking System. *Economic Notes: Review of Banking, Finance and Monetary Economics*, 47(1), 187-222.

Castro, M. P., & Zermeño, M. G. G. (2020). Being an entrepreneur post-COVID-19–resilience in times of crisis: a systematic literature review. *Journal of Entrepreneurship in Emerging Economies*, 13(4), 721-746.

Cefis, E., & Marsili, O. (2005). A matter of life and death: innovation and firm survival. *Industrial and Corporate change*, 14(6), 1167-1192.

Chang, Y., Gomes, J. F., & Schorfheide, F. (2002). Learning-by-doing as a propagation mechanism. *American Economic Review*, *92*(5), 1498-1520.

Cheratian, I., Golpe, A., Goltabar, S., & Iglesias, J. (2019). The unemployment-entrepreneurship nexus: new evidence from 30 Iranian provinces. *International Journal of Emerging Markets*, 15(3), 469-489.

Cheratian, I., Goltabar, S., & Calá, C. D. (2021). Spatial drivers of firm entry in Iran. *The Annals of Regional Science*, 66(2), 463-496.

Comin, D., Groshen, E. L., & Rabin, B. (2009). Turbulent firms, turbulent wages?. *Journal of Monetary Economics*, *56*(1), 109-133.

Cornille, D., Rycx, F., & Tojerow, I. (2019). Heterogeneous effects of credit constraints on SMEs' employment: Evidence from the European sovereign debt crisis. *Journal of Financial Stability*, 41, 1-13.

Covin, J. G., & Lumpkin, G. T. (2011). Entrepreneurial orientation theory and research: Reflections on a needed construct. *Entrepreneurship theory and practice*, 35(5), 855-872.

Cowling, M., Liu, W., Ledger, A., & Zhang, N. (2015). What really happens to small and medium-sized enterprises in a global economic recession? UK evidence on sales and job dynamics. *International Small Business Journal*, *33*(5), 488-513.

Cowling, M., Liu, W., & Zhang, N. (2016). Access to bank finance for UK SMEs in the wake of the recent financial crisis. *International Journal of Entrepreneurial Behavior & Research*, 22(6), 903-932.

Cowling, M., Liu, W., & Zhang, N. (2018). Did firm age, experience, and access to finance count? SME performance after the global financial crisis. *Journal of Evolutionary Economics*, *28*(1), 77-100.

Cowling, M., Liu, W., & Zhang, N. (2021). In the post-crisis world, did debt and equity markets respond differently to high-tech industries and innovative firms?. *International Small Business Journal*, 39(3), 247-288.

D'Amato, A. (2019). How did the global financial crisis impact the determinants of SMEs' capital structure?. *International Journal of Globalisation and Small Business*, 10(3), 210-232.

Danaher, P. J., & Rust, R. T. (1994). Determining the optimal level of media spending. *Journal of Advertising Research*, 34(1), 28-35.

Dizaji, S. F. (2014). The effects of oil shocks on government expenditures and government revenues nexus (with an application to Iran's sanctions). *Economic Modelling*, 40, 299-313.

Dizaji, S. F. (2019). Trade openness, political institutions, and military spending (evidence from lifting Iran's sanctions). *Empirical Economics*, 57(6), 2013-2041.

Dizaji, S. F., & Farzanegan, M. R. (2020). Do sanctions constrain military spending of Iran?. *Defence and Peace Economics*, 32(2), 125-150.

Doms, M., Lewis, E., & Robb, A. (2010). Local labor force education, new business characteristics, and firm performance. *Journal of Urban Economics*, 67(1), 61-77.

Dyer, J. H., & Singh, H. (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review*, 23(4), 660-679.

Eggers, F., & Kraus, S. (2011). Growing young SMEs in hard economic times: the impact of entrepreneurial and customer orientations—a qualitative study from Silicon Valley. *Journal of Small Business & Entrepreneurship*, 24(1), 99-111.

Eggers, F., Hansen, D. J., & Davis, A. E. (2012). Examining the relationship between customer and entrepreneurial orientation on nascent firms' marketing strategy. *International Entrepreneurship and Management Journal*, 8(2), 203-222.

Fabiani, S., Lamo, A., Messina, J., & Rõõm, T. (2015). European firm adjustment during times of economic crisis. *IZA Journal of Labor Policy*, 4(1), 1-28.

Farjadi, G., Amini, A., & Alaedini, P. (2018). Employment of highly educated labor force in Iran: Challenges and prospects through the sixth development plan and beyond. In Industrial, Trade, and Employment Policies in Iran (pp. 247-267). Springer, Cham.

Farzanegan, M. R., & Alaedini, P. (2016). *Economic welfare and inequality in Iran*. Palgrave Macmillan.

Farzanegan, M. R., & Fischer, S. (2021). Lifting of International Sanctions and the Shadow Economy in Iran—A View from Outer Space. *Remote Sensing*, 13(22), 4620.

Farzanegan, M. R., & Hayo, B. (2019). Sanctions and the shadow economy: empirical evidence from Iranian provinces. *Applied Economics Letters*, 26(6), 501-505.

Farzanegan, M. R., Khabbazan, M. M., & Sadeghi, H. (2016). Effects of oil sanctions on Iran's economy and household welfare: new evidence from a CGE model. In Economic welfare and inequality in Iran (pp. 185-211). Palgrave Macmillan, New York.

Farzanegan, M.R. (2011). Oil revenues shocks and government spending behavior in Iran. *Energy Economics*, 33(6), 1055-1069.

Farzanegan, M.R. (2013). Effects of international financial and energy sanctions on Iran's informal economy. *The SAIS Review of International Affair*, 33, 13-36.

Farzanegan, M.R. (2021). The effects of international sanctions on Iran's military spending: A synthetic control analysis. Defence and Peace Economics. https://doi.org/10.1080/10242694.2021.1941548 (in press).

Forbes, K. J. (2002). How do large depreciations affect firm performance?. *IMF Staff Papers*, 49(1), 214-238.

Geroski, P. A., & Gregg, P. (1997). *Coping with recession: UK company performance in adversity* (No. 38). Cambridge University Press.

Gertler, M., & Gilchrist, S. (1994). Monetary policy, business cycles, and the behavior of small manufacturing firms. *The Quarterly Journal of Economics*, 109(2), 309-340.

Gharibnavaz, M. R., & Waschik, R. (2018). A computable general equilibrium model of international sanctions in Iran. *The World Economy*, 41(1), 287-307.

Ghorbani Dastgerdi, H., Yusof, Z. B., & Shahbaz, M. (2018). Nexus between economic sanctions and inflation: a case study in Iran. *Applied Economics*, 50(49), 5316-5334.

Greenberg, E. R. (1993). Fortune follows the brave. *Management Review*, 82(1), 6-7.

Greene, W. (2012). *Econometric analysis*. Pearson.

Groenewegen, J., Hardeman, S., & Stam, E. (2021). Does COVID-19 state aid reach the right firms? COVID-19 state aid, turnover expectations, uncertainty and management practices. *Journal of Business Venturing Insights*, 16, e00262.

Grube, L. E., & Storr, V. H. (2018). Embedded entrepreneurs and post-disaster community recovery. *Entrepreneurship & Regional Development*, 30(7-8), 800-821.

Haidar, J. I. (2017). Sanctions and export deflection: evidence from Iran. *Economic Policy*, 32(90), 319-355.

Haltiwanger, J. C. (2021). Entrepreneurship During the COVID-19 Pandemic: Evidence from the Business Formation Statistics (No. w28912). National Bureau of Economic Research.

Herbane, B. (2010). Small business research: time for a crisis-based view. *International Small Business Journal*, 28(1), 43-64.

Hite, J. M., & Hesterly, W. S. (2001). The evolution of firm networks: From emergence to early growth of the firm. *Strategic Management Journal*, 22(3), 275-286.

Jacobson, M. (2008). Sanctions against Iran: A promising struggle. *Washington Quarterly*, 31(3), 69-88.

Jarmin, R. S., Krizan, C. J., & Luque, A. (2014). Owner characteristics and firm performance during the great recession. US Census Bureau Center for Economic Studies Paper No. CES-WP-14-36.

Jung, H., Hwang, J., & Kim, B. K. (2018). Does R&D investment increase SME survival during a recession?. *Technological Forecasting and Social Change*, 137, 190-198.

Khabbazan, M. M., & Farzanegan, M. R. (2016). Household welfare in Iran under banking sanctions: from open economy toward autarchy. In Economic Welfare and Inequality in Iran (pp. 213-232). Palgrave Macmillan, New York.

Kim, Y. J., Tesar, L. L., & Zhang, J. (2015). The impact of foreign liabilities on small firms: Firm-level evidence from the Korean crisis. *Journal of International Economics*, 97(2), 209-230.

Kudlyak, M., & Sanchez, J. M. (2017). Revisiting the behavior of small and large firms during the 2008 financial crisis. *Journal of Economic Dynamics and Control*, 77, 48-69.

Lai, Y., Saridakis, G., Blackburn, R., & Johnstone, S. (2016). Are the HR responses of small firms different from large firms in times of recession?. *Journal of Business Venturing*, *31*(1), 113-131.

Latham, S. (2009). Contrasting strategic response to economic recession in start-up versus established software firms. *Journal of Small Business Management*, 47(2), 180-201.

Lawless, M., O'Connell, B., & O'Toole, C. (2015). SME recovery following a financial crisis: Does debt overhang matter?. *Journal of Financial Stability*, 19, 45-59.

Lee, H., Kelley, D., Lee, J., & Lee, S. (2012). SME survival: The impact of internationalization, technology resources, and alliances. *Journal of Small Business Management*, 50(1), 1-19.

Lee, N., Sameen, H., & Cowling, M. (2015). Access to finance for innovative SMEs since the financial crisis. *Research Policy*, 44(2), 370-380.

Long, J. S., & Long, J. S. (1997). Regression models for categorical and limited dependent variables (Vol. 7). Sage.

Mahmood, T. (2000). Survival of newly founded businesses: A log-logistic model approach. *Small Business Economics*, 14(3), 223-237.

Marino, L. D., Lohrke, F. T., Hill, J. S., Weaver, K. M., & Tambunan, T. (2008). Environmental shocks and SME alliance formation intentions in an emerging economy: Evidence from the Asian financial crisis in Indonesia. *Entrepreneurship Theory and Practice*, 32(1), 157-183.

McKenzie, D. (2017). Identifying and spurring high-growth entrepreneurship: Experimental evidence from a business plan competition. *American Economic Review*, 107(8), 2278-2307.

Narjoko, D., & Hill, H. (2007). Winners and losers during a deep economic crisis: Firm-level evidence from Indonesian manufacturing. *Asian Economic Journal*, 21(4), 343-368.

Navarro, P. (2009). Recession-proofing your organization. *MIT Sloan Management Review*, 50(3), 45.

Neuenkirch, M., & Neumeier, F. (2015). The impact of UN and US economic sanctions on GDP growth. *European Journal of Political Economy*, 40, 110-125.

Nugent, J. B., & Yhee, S. J. (2002). Small and medium enterprises in Korea: Achievements, constraints and policy issues. *Small Business Economics*, 18(1), 85-119.

O'Malley, L., Story, V., & O'Sullivan, V. (2011). Marketing in a recession: retrench or invest?. *Journal of Strategic Marketing*, 19(3), 285-310.

Pérez-Estébanez, R., Urquía-Grande, E., & Cañizares-Espada, M. (2018). ICT consolidate in European firms despite the economic crisis. *RAITES (antes Panorama Administrativo)*, 4(8), 10-30.

Peric, M., & Vitezic, V. (2016). Impact of global economic crisis on firm growth. *Small Business Economics*, 46(1), 1-12.

Ramalho, J. J., Rita, R. M., & da Silva, J. V. (2018). The impact of family ownership on capital structure of firms: Exploring the role of zero-leverage, size, location and the global financial crisis. *International Small Business Journal*, 36(5), 574-604.

Rasekhi, S., Cheratian, I., & Pourfaraj, A. (2019). Does Firm Size Affect Worker Earnings? Case of Iranian Manufacturing Enterprises. *Institutions and Economies*, 119-143.

Ravichandran, T., Lertwongsatien, C., & Lertwongsatien, C. (2005). Effect of information systems resources and capabilities on firm performance: A resource-based perspective. *Journal of Management Information Systems*, 21(4), 237-276.

Reid, G. (2007). *The Foundations of Small Business Enterprise: an entrepreneurial analysis of small firm inception and growth*. Routledge.

Rones, P. L. (1981). Response to recession: reduce hours or jobs. *Monthly Lab. Rev.*, *104*, 3.

Sakas, D., Vlachos, D., & Nasiopoulos, D. (2014). Modelling strategic management for the development of competitive advantage, based on technology. *Journal of Systems and Information Technology*, 16(3), 187-209.

Schoonjans, B., Van Cauwenberge, P., & Vander Bauwhede, H. (2013). Formal business networking and SME growth. *Small Business Economics*, 41(1), 169-181.

Serrasqueiro, Z., Leitão, J., & Smallbone, D. (2018). Small-and medium-sized enterprises (SME) growth and financing sources: Before and after the financial crisis. *Journal of Management & Organization*, 27(1), 6-21.

Shirazi, H., Azarbaiejani, K., & Sameti, M. (2016). The Effect of Economic Sanctions on Iran's Exports. *Iranian Economic Review*, 20(42), 111-124.

Simón-Moya, V., Revuelto-Taboada, L., & Ribeiro-Soriano, D. (2016). Influence of economic crisis on new SME survival: reality or fiction?. *Entrepreneurship & Regional Development*, 28(1-2), 157-176.

Solow, R. M. (1979). Another possible source of wage stickiness. *Journal of Macroeconomics*, 1(1), 79-82.

Srinivasan, R., Rangaswamy, A., & Lilien, G. L. (2005). Turning adversity into advantage: does proactive marketing during a recession pay off?. *International Journal of Research in Marketing*, 22(2), 109-125.

Tan, H. H., & See, H. H. (2004). Strategic reorientation and responses to the Asian financial crisis: The case of the manufacturing industry in Singapore. *Asia Pacific Journal of Management*, 21(1), 189-211.

Ter Wengel, J., & Rodriguez, E. (2006). SME export performance in Indonesia after the crisis. *Small Business Economics*, 26(1), 25-37.

Tomohara, A., & Ohno, A. (2013). What are relevant work incentive models? Shirking model, gift exchange model, or reciprocity model. *Journal of Labor Research*, 34(2), 241-252.

Tubbs, M. (2007). The relationship between R&D and company performance. *Research-Technology Management*, 50(6), 23-30.

Varum, C. A., & Rocha, V. C. (2012). The effect of crises on firm exit and the moderating effect of firm size. *Economics Letters*, 114(1), 94-97.

Varum, C. A., & Rocha, V. C. (2013). Employment and SMEs during crises. *Small Business Economics*, 40(1), 9-25.

Watson, J. (2007). Modeling the relationship between networking and firm performance. *Journal of Business Venturing*, 22(6), 852-874.

World Bank (2021). World Development Indicators 2021, Washington DC. Available from https://databank.worldbank.org/source/world-development-indicators#

World Bank. (2020). Doing Business 2020. Washington DC: World Bank. DOI:10.1596/978-1-4648-1440-2. License: Creative Commons Attribution CC BY 3.0 IGO.

Yazdanfar, D., Öhman, P., & Homayoun, S. (2019). Financial crisis and SME capital structure: Swedish empirical evidence. *Journal of Economic Studies*, 46(4), 925-941.

Zamani, O., Farzanegan, M., Loy, J. P., & Einian, M. (2021). The Impacts of Energy Sanctions on the Black-Market Premium: Evidence from Iran. *Economics Bulletin*, 41(2), 432-443.

Zubair, S., Kabir, R., & Huang, X. (2020). Does the financial crisis change the effect of financing on investment? Evidence from private SMEs. *Journal of Business Research*, 110, 456-463.

Appendix 1 The impact of economic and financial crisis on SMEs: Review of related studies

Author(s) and year	Sample size and time period	Methodology	Type of crisis	Main findings
Varum and Rocha (2013)	Portugal (1988-2007)	Panel data	Economic	The results show that the negative effect of economic downturns on large firms is higher than SMEs. However large firms can recover more quickly.
Peric and Vitezic (2016)	Croatia (2008-2013)	Two-step dynamic panel	Economic	The Authors found that during the economic recession, the potential of growth in large and medium-sized enterprises is more than small ones. Furthermore, small firms have shown less vulnerability in job destruction compared to their medium and large counterparts.
Lee et al. (2015)	UK (2007/8-2010/12)	Probit regression	Financial	During the financial crisis, innovative UK firms had a harder situation in accessing finance than other firms.
Cowling et al. (2018)	UK (2010)	OLS and Quantile	Financial	Regarding the severity of the crisis, entrepreneurs' previous experiences had substantive effects on small business performance. However, young small firms grew faster on average than their older counterparts.
Forbes (2002)	Around the world (1997-1999)	Panel data	Currency	During large depreciations, performance of larger firms is usually worse than smaller firms, although the robustness of this results changes across different specifications.
Lawless et al. (2015)	Ireland (2003-2014)	Ordered probit regression	Financial	The results show the negative effects of debt burdens on firm performance (such as investment and employment). Although, the crisis has the greatest effect on enterprises and sectors which rely on domestic demand and were in the mild-lifecycle.
Simón -Moya et al. (2016)	Valencia (2000-2005)	Binary logistic regression	Economic	The authors found that during crises, entrepreneurs have a greater likelihood of surviving compared to growth periods. Furthermore, the gaps of surviving between opportunity and necessity entrepreneurship are bigger in crisis times rather than growth periods.

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Appendix 1 Continued

Author(s) and year	Sample size and time period	Methodology	Type of crisis	Main findings
Cowling et al. (2015)	UK (2007-2008)	OLS and Probit regression	Financial	During the recession, about 40 percent of SMEs experienced a fall in employment and 50 percent experienced a fall in sales. However, within 12 months of the recession about 75 percent of firms had a desire to grow.
Marino et al. (2008)	Indonesia (1997)	OLS	Financial	The results show that firms' responses on financial crisis varied based on whether the shocks have permanent or temporary impacts on the industries.
Carbo-Valverde et al. (2016)	Spain (1994-2006)	Switching regression model	Financial	Credit constrained small and medium firms depend on trade credit, and during the financial crisis, the intensity of this dependence increased. In contrast, unconstrained firms, are dependent on bank loans rather than trade credit.
D'Amato (2019)	Italy (2006-2016)	Panel data	Financial	Due to the negative shocks to credit supply, SMEs leverage (especially short-term debt exposure) significantly decreased during and after the 2007-08 financial crisis.
Kudlyak and Sanchez (2017)	US (1958-2009)	Gertler and Gilchrist (1994)	Financial	The authors show that during 2007–09 financial crisis, low financially dependent firms suffered more than high financially-dependent firms. These results favor the view that a tightening of a financial or collateral constraints might not be a good representation of the 2007–09 crisis.
Zubair et al. (2020)	Netherland (2004-2012)	Panel fixed effect	Financial	During and after the 2007-2008 financial crisis, investment by private SMEs declined significantly. Furthermore, borrowing from banks was critical in determining the private enterprises investment during the crisis period.
Yazdanfar et al. (2019)	Sweden (2008-2015)	OLS and GMM	Financial	During the crisis, Swedish SMEs rely more on short- and long-term debt than after the crisis period. Moreover, some internal and external factors (such as profitability, size, financial crisis, tangibility, and industry affiliation) explain the changes of SMEs short- and long-term debt ratios.

Appendix 1 Continued

Author(s) and year	Sample size and time period	Methodology	Type of crisis	Main findings
Kim et al. (2015)	Korea (1994-1999)	Panel fixed effect	Financial	Regarding the large exchange rate depreciation during the 1997-98 crisis, SMEs with more short-term foreign debt experienced larger declines in sales and were more likely to declare bankruptcy.
Bussoli and Marino (2018)	Europe (2005-2013)	GMM	Financial	SMEs use trade credit more extensively when they face a high probability of insolvency. Weaker and distressed firms are less able to match their revenues to their costs. Finally, the results show that the substitution hypothesis is weakened and liquidity shocks are propagated through trade credit channels during financial crises.
Cornille et al. (2019)	Europe (2014)	OLS	Financial	Credit constraint mainly affects SMEs borrowing money from financially less healthy banks during the pre-crisis period and, in turn, had to adjust their labor input downwards than pre-crisis clients of healthier banks.
Barron et al. (2012)	France, Sweden and the UK (2009)	Kruskal–Wallis H test	Financial	The monitoring of political initiatives by small and medium enterprises in response to the recession varied in accordance with the extent to which their countries are affected by the recession. Also, small business managers, on the whole, considered it more important, despite the international nature of the crisis, to monitor political responses in national rather than supranational political settings.
Castellani (2018)	Italy (2007-2014)	GMM	Financial and economic	During the financial crisis, banks securitization has not directly affected the supply of new SMEs loans.
Beliaeva et al. (2020)	Russia (2015-2016)	Hierarchical OLS	Economic	The results show a positive and significant effect of entrepreneurial orientation and a non-significant effect of market orientation during the economic crisis.
Eggers and Kraus (2011)	Silicon Vallley (2009)	Interview	Economic	The authors found that the interplay of entrepreneurial orientation and customers constitutes the discipline of entrepreneurial marketing. However, entrepreneurial marketing orientation requires at least a certain amount of resources—a challenge in hard economic times.