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Estimation Non-Linearity Effect of Competitiveness on Innovation in Iranian Industries: Emphasizing Different Levels of Industry Technology And the Poisson Pseudo-maximum Likelihood Method And Panel Threshold Regression

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Abstract

Considering the importance of the competitiveness on innovation, the present study examines the nonlinear impact of competitiveness on innovation with the use of the Poisson pseudo maximum likelihood (PPML) method. For this purpose, the data of Iran's industry was used according to the International Standard Industrial Activities Classification (ISIC) for the period of 2004-2014. To calculate the competitiveness index three indexes such as Herfindahl, Entropy and Inverse number of firm indicators were used. Based on the results, two Herfindahl and Entropy indicators emphasized the effect of nonlinear and U-form of competitiveness on innovation. Monopoly threshold level formed a panel regression model (PTR) that 17% was obtained for the Herfindahl index and 50% for Entropy index. Investigating the effect of competitiveness on innovation in two groups of industries that are distinguished based on technology gap Showed that industries competing on a level of technology, the motivation for innovate and escape from the competition is more. Also, The results also imply on negative effect of exit rates and positive and significant effect of technology gap on innovation.

Keywords: competitiveness, innovation, PPML model, threshold level.

Jel Classification: D22, L60, O31.

1. Introduction

In recent years, with the advent of the knowledge-based economy, innovation has played a more crucial role in the transformation of economic and social structures. Also, in the past half century, policy makers have been interested in developing knowledge-based innovation policies as a driving force for economic development (Entezari, 2005: 220). There are different views about how firms' performance and competitiveness is affecting innovation. Some of these views emphasize the schumpeterian effect on innovation, which means that increased competitiveness within the industry reduces innovation in the industry. A

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number of other theories such as that of Arrow (1962) have considered the positive effect of competition on innovation. The third approach emphasizes the nonlinear relationship between competition and innovation. This approach, which has been the focus of the recent studies, is based on Scherer's (1967) views and is the subject of this paper. Therefore, the purpose of this study is to examine the relationship between competitiveness and innovation in Iranian industries with an emphasis on the third approach. This study is one of the few studies in the field that studies the existence of nonlinear competitiveness on innovation at the industrial level with different levels of technology in Iran. For this purpose, the Poisson Pseudo-Maximum likelihood (PPML) method in econometrics was used. To calculate competitiveness, three indicators were used.

2. Research background

Using panel data from 311 producers in the United Kingdom, Aghion et al. (2005) emphasized the nonlinear relationship between innovation and competition at the firm level. Correa (2012) and Hashmi (2013) used the model presented by Aghion et al. (2005) and came up with the same result. Beneito et al. (2017) used the model for Spanish companies for the period of 1990-2006, but their findings, instead of an inverted-U shape relationship, indicated a positive relationship between innovation and competition. In an analysis of the equilibrium relationship between market structure and innovation in the global automotive industry Hashmi and Van Biesebroeck (2016) showed that optimal innovation has an inverted-U shape relationship with the quality level in industry. With increased entry into the industry, the innovation of each firm has declined, but in general the industries' innovation has increased, which is the result of the Schumpeter's competitiveness effect. Askenazy et al. (2013) also used the Aghion model and found a nonlinear relationship between competition and innovation. Peroni & Gomes's (2012) study rejected the non-linear relationship for the Luxembourg state. The results of Dehghani et al.'s (2014) study pointed to the negative impact of the R&D cost on the degree of concentration in the industry. Yousefi Haji Abad and Khodadad Kashi (2013) and Khodadad Kashi (2000) showed that the performance of the industrial sector has significant and sustained effects on the level of market concentration.

3. Research model

In this study, we used Benito and et al.'s (2017) model. This model is the modified version of Aghion et al.'s (2005) model. It has two parts. Part one is firms' response, based on their type of activity, to increased competition. so that in firms with equal technological levels, the escape competition effect is shown with the Schumpeterian effect (neck-and-neck sectors). This effect is different in firms with various technological levels (leaderand-laggard sectors). The escape competition effect is expected to be stronger for firms in NN sectors

because in these sectors the difference between pre- and post-innovation rents is larger and increases with competition. By contrast, the Schumpeterian effect dominates the LL sectors. It should be noted that, the aggregate innovation rate follows an inverted-U pattern because of the composition effect of competition. For low levels of competition, there is a larger fraction of NN sectors, whereas for high levels of competition the fraction of LL sectors is large. The justification is that when the initial level of competition is low, escape competition incentives for innovation are also low. Therefore, firms in NN sectors do not innovate so that the sectors remain NN. However, when competition is low, laggards in LL sectors have incentives to innovate because they can get and appropriate relevant post entry rents from innovation, moving the industrial into more NN. Conversely, when initial competition is high, firms in NN sectors have large incentives for innovation to escape competition, leading NN sectors to become LL sectors. In this study, based on the modified model Aghion and et al. (2005), we used an intensity indicator of research and development to calculate innovation, which is measured as the ratio of research and development costs to sales. Two models were estimated. The equations in this study are as follows:

$$Patent_{jt} = \beta_{7j} HHI_{jt} + \beta_{8j} HHI_{jt}^2 + \beta_{9j} Exit_{jt} + \beta_{10j} Gap_{jt} + \mu_{jt} \quad (1)$$

$$Patent_{jt} = \beta_{11j} En_{jt} + \beta_{12j} En_{jt}^2 + \beta_{13j} Exit_{jt} + \beta_{14j} Gap_{jt} + \omega_{jt} \quad (2)$$

where, $Patent_{jt}$ represents the Innovation firm (j) at time (t). HHI denotes te Herfindahl index. En is the Entropy index, $Exit$ shows the exit rate and *Gap* repsentsd technology gap. Based on the results obtained from both Herfindahl and Entropy indicators, innovation is reduced by increasing firms' exit and reducing technology gap in industries. Also, the threshold for the Harpindal index was 17% and for the entropy index it was estimated to be 50%.

4. Conclusion

This article examined the impact of competitiveness on innovation in the Iranian industries during the period of 2004-2014. In this research as an innovation Variables technology gap in the industry and exit rates was used. To calculate the competitiveness index three indexes including Herfindahl, Entropy and Inverse number of firm indicators were used. Based on the results, Herfindahl and Entropy indicators emphasized the nonlinear and U-shaped effect of competitiveness on innovation. This result is consistent with the findings of Benito and et al. (2017). Also, based on the Inverse number of firm, the effect of competition on innovation was not significant. Investigating the effect of competitiveness on innovation in two groups of industries that are based on technology gap, we found that the U-form reverse effect of competitiveness on innovation is not rejected in a group with the same level of technology. Monopoly threshold level with existence of a nonlinear relationship, was determined. The threshold was estimated to be 17% for the Harpindal index and

50% for the entropy index. The results imply point to the negative effect of exit rate and positive and significant effect of technology gap on innovation. According to the results, it is recommended that politicians plan and coordinate their policies for developing competitiveness. For example, the development of the relationship between industry and the university can have positive effects on technological, economic and social development.

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