



# Slack and innovation: Investigating the relationship in Korea



Sanghoon Lee \*

Department of Economics, Hannam University, 70 Hannamro, Daedeok Gu, Daejeon306-791, Republic of Korea

## ARTICLE INFO

### Article history:

Received 4 September 2013  
 Received in revised form 18 December 2014  
 Accepted 19 December 2014  
 Available online 3 January 2015

### Keywords:

Organizational slack  
 Innovation  
 R&D investment  
 Korea

## ABSTRACT

This study investigates how organizational slack affects innovation by using a panel data set consisting of Korean firms over the 1999–2008 period. Especially, the relationship between financial slack and R&D investment is of concern. We extend previous work on slack and innovation by using dynamic GMM estimation, split-sample method, and other econometric techniques. The empirical analysis shows that the relationship between slack and innovation is weak in Korea, and small firms and young firms create a favorable environment for managers to use slack resources to invest in innovation. The results imply that the relationship between slack and innovation depends on the distinct social and institutional settings in which firms operate and on the organizational characteristics of the firm.

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## 1. Introduction

Organizational slack refers to slack resources “which are not committed to a necessary expenditure” and “can be used in a discretionary manner” in an organization (Dimick & Murray, 1978, p.616). Organizational research often argues that organizational slack positively affects firm performance since managers use slack resources to invest in innovative activities which are indispensable to firm performance. The positive relationship between slack and performance is supported by many empirical studies (Daniel, Lohrke, Fornaciari, & Turner, 2004). A recent study by Bradley, Shepherd, and Wiklund (2011) shows that the positive relationship is strong in low discretion environments where firms need to develop their own opportunities. However, empirical verification of the direct relationship between slack and innovation is scarce, although the issue has been analyzed theoretically (Huang & Chen, 2010, p.420).

This paper empirically examines the relationship between organizational slack and innovation. Organizational slack includes financial slack and slack in human resources (Voss, Sirdeshmukh, & Voss, 2008, p.149). The current study considers financial slack as a proxy for organizational slack since financial slack includes cash and receivables which is highly flexible, and thus gives managers more discretionary power than other types of slack (Kim, Kim, & Lee, 2008, p.405). In contrast, slack in human resources is not flexible. Since R&D employees such as scientists and engineers create tacit knowledge that is embedded in them and is lost when such employees are fired, firms tend not to lay off R&D workers (Hall, 2005; Hall, Griliches, & Hausman, 1986; Lach & Schankerman, 1988). Thus, it is difficult to quickly adjust slack in human resources to

economic conditions. Moreover, financial slack is easy to accurately measure, which may be the reason most empirical studies of organizational slack use financial slack variables. Only a few studies (i.e., Yao & Yang, 2007) examine slack in human resources by using questionnaire data.

As an innovation indicator, we use R&D expenditures, which is common in the literature (Geiger & Cashen, 2002, p.74). R&D investment plays an important role as a driving force of economic performance, which has been confirmed by empirical evidence (for an extensive empirical study, see Guellec & van Pottelsberghe de la Potterie, 2001). R&D investment has some characteristics distinguished from ordinary investment. First, most R&D spending is in the wages and salaries of qualified scientists and engineers, and thus firms tend to smooth their R&D spending over time in order to not lay off them. Thus R&D projects have high adjustment costs. Second, the expected outcomes of R&D projects are highly uncertain. Thus, it is risky to invest in R&D projects. Third, the information asymmetry is much larger in R&D than in ordinary investment, and thus it is difficult for outside investors to evaluate R&D projects (Hall, 2002).

The current study empirically examines the relationship between slack and innovation by using firm-level panel data from South Korea. The novelty of this study is to extend previous work on slack and innovation by using more sophisticated methodology including GMM estimation and a sample splitting method, and by considering the corporate governance setting in Korea, a recently developed country. Over four decades, Korea has achieved great economic development, and technological innovation was one of the engines of the “Korean miracle” (Chung, 2010, pp.333–334). Indeed, public as well as private R&D investment in Korea is large. For example, according to the Global Innovation 1000 Study published by Booz & Company in 2003, Samsung, a Korean electronics company, ranked second in R&D spending

\* Tel.: +82 42 629 7614; fax: +82 42 672 7602.  
 E-mail address: sanghoonlee@hannam.ac.kr.

in 2003. According to another report, The Most Innovative Companies 2012 by the Boston Consulting Group, Hyundai, the Korean car manufacturer, was the most innovative company in automotive fields. In addition, R&D expenditure in Korea is relatively high among OECD countries. According to the OECD 2005 statistics, expenditure on R&D as a percentage of GDP in Korea was 2.98%, while, for the top 10 OECD countries in terms of GDP, except Korea, the average was 1.89%. Thus, research on the effect of slack on R&D in Korea would have significant implications to other countries.

The structure of the paper is as follows. Section 2 discusses theoretical background and presents the hypothesis to be tested in the study. Previous empirical studies are examined in Section 3. The data and the methodology are described in Section 4. The empirical findings are presented and discussed in Section 5. In Section 6 we summarize and discuss our conclusions.

## 2. Theories

Many theories argue that investment in innovation increases as organizational slack increases. Typical organization theories argue that organizational slack is likely to spur investment in innovation. According to the behavioral theory of the firm, organizational slack provides funds for innovation since “risk taking appears to be affected by the presence of resource in excess of current aspirations” and the presence of organizational slack “tends to lead to relaxation of controls, reduced fears of failure, institutionalized innovation, and increased experimentation, thus to relatively high levels of risk taking” (Cyert & March, 1963, p.228). Slack plays a role as a cushion which “allows an organization to adapt successfully to internal pressures for adjustment or to external pressures for change in policy” (Bourgeois, 1981, p.30). If firms do not have sufficient slack resources in times of adversity, the firms are forced to cut back or postpone new investment outlays. Probably, innovative projects are most likely to be sacrificed in those times because the outcomes of those projects are uncertain. Slack buffers organizations from downside risk, and innovation activities can be easily justified in the presence of slack. In addition, according to the resource-based view of the firm, slack resources can provide services at zero marginal cost since they have already been obtained, thus motivating managers to conduct innovative and risky projects (Pitelis, 2007, p.480).

From a finance theory perspective, firms prefer internal funds over external funds to finance innovative investment in the presence of asymmetric information between the firm and outside investors (Myers & Majluf, 1984). This argument is called the hierarchical or “pecking order” theory. Under a problem of asymmetric information in investment, it is difficult to evaluate investment projects and thus investors would ask for a premium on their funds (Leland & Pyle, 1977). This makes firms prefer internal funding to external funding. Since the problem of asymmetric information is particularly severe in innovation activities (see, for surveys Hall, 2002; Hubbard, 1998), the positive effect of internal slack on innovation should be expected.

The agency framework developed by Jensen and Meckling (1976) also suggests that slack leads to the pursuit of innovation investment, although its efficiency is doubtful. In this theory, or “free cash flow” hypothesis, managers are the agents of shareholders and have incentives to make the firm grow since growth increases managers' power by increasing the resources under their control. Managers with substantial free cash flow would invest in as many projects as possible even though the projects are risky and without positive net present values (Jensen, 1986). The free cash flow theory argues that access to free cash flow induces managers to invest in even negative present value activities to get private benefits, thus leading to poorer management performance. However, the theory still holds that free cash flow leads to more investment.

In sum, many theories such as the behavioral theory of the firm, the resource-based view of the firm, the pecking order theory, and the

free cash flow theory, suggest that organizational slack facilitates and stimulates investment in innovation. Thus, the hypothesis to be tested in this study is as follows:

**Hypothesis.** Organizational slack positively affects innovation investment.

In contrast to the theoretical discussion, existing empirical studies of the relationship between slack and innovation tell a different story, which is discussed in detail in the following section.

## 3. Previous studies

Singh (1986) provides evidence in support of the theoretical prediction of the positive relationship between slack and risk taking, while Chen and Huang (2010), Franquesa and Brandyberry (2009), and Greve (2003) yield insignificant and/or mixed results. However, most empirical works of slack and innovation provide support for an inverse U-shaped relationship between slack and innovation. The previous studies are summarized by Table 1.

The inverse U-shaped relationship between slack and innovation is explained as follows (see Nohria & Gulati, 1996). Slack fosters greater experimentation but simultaneously diminishes discipline over innovative projects. Managers with sufficient slack resources tend to be less stringent and this lax discipline increases “the risk that projects will be abandoned simply because some ran out of energy, got bored, or ran into a tough problem” (Nohria & Gulati, 1996, p.1249). Thus, if too much slack is detrimental to innovation and this negative impact begins to outweigh the positive at higher levels of slack, the inverse U-shaped relationship between slack and innovation can be observed.

The empirical studies by Geiger and Cashen (2002), Herold et al. (2006), Kim et al. (2008), and Nohria and Gulati (1996) confirm the inverse U-shaped relationship between slack and innovation. The studies report the negative sign of the quadratic term of slack and present it as evidence of the inverse U-shaped relationship. However, we believe that the empirical results of the existing studies cannot be interpreted as supporting the inverse U-shaped relationship since the results do not necessarily guarantee an inverse U-shaped relationship. “To do so would require the demonstration of an inflection point beyond which the curve becomes downward sloping, as opposed to just asymptotic, and a demonstration that this point is not just a statistical abstraction, but that it is within the range of acceptable or realistic values of the independent variable” (Herold et al., 2006, p.384).

Among the four studies that argue for the inverse U-shaped relationship, Nohria and Gulati (1996) and Herold et al. (2006) explicitly consider the requirement of the inverse U relationship. Nohria and Gulati (1996, p.1259) show that the inflexion point “occurs at a slack score ranging from 32 to 34 (on a scale of 0 to 60),” which implies that the evidence meets the requirement. However, Herold et al. (2006, p.384) find that the inflexion point for the quick ratio representing the measure of slack is “4.57 for the 1994 data and 4.14 for the 1998 data. Only two firms out of 212 and four firms out of 242 in the 1994 and 1998 data, respectively, had quick ratios greater than these values.” This indicates that the inflexion point is beyond the acceptable range. Thus, among the two studies that determine whether the requirement is met or not, only one study can pass the requirement of the inverse U-shaped relationship. The other study supports a positive relationship between slack and innovation rather than the inverse U relationship since the curve is upward sloping within the acceptable range.

The two other studies (Geiger & Cashen, 2002; Kim et al., 2008) do not examine the requirement. We determine whether the requirement is satisfied or not for the studies by plotting the relationship between slack and innovation using the estimates reported by the two studies, which are shown in Figs. 1 and 2, respectively. The horizontal axis represents the level of slack and the vertical axis represents the level of innovation. In Figs. 1 and 2, the left column shows the relationship

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