



# Divergent effects of external financing on technology innovation activity: Korean evidence



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## ABSTRACT

This paper explores a variety of effects of external financing subdivided into bank loans and bond and stock issues on the technology innovation activity (TIA) of Korean listed firms for the full sample period of 1st January 2000 to 31st December 2008. We find evidence that indirect external financing of bank loans makes a negative impact on TIA of the Korean firms whereas direct external financing of security issues does a positive one on it. The results support the hypothesis of manager discretion that banks' conservative lending criteria demanding considerable collaterals from firms discourage managers from an investment in TIA with high risk-high return while external financing via security issues grants managers more discretion for their TIA. This study building up the prior literature that primarily devote to an effect of internal financing on TIA of firms provides firm managers or academic researchers with valuable implications for evaluation of various impacts and roles of external financing in association with financing decisions for TIA of firms.

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## 1. Introduction

Since outstanding academics of Schumpeter (1942) and Solow (1957) proposed that innovation is an essential factor for firm and economic growth in the country, the definition of innovation and factors to boost it within firms have been a primary concern to academics of innovation for the last decades. According to Becheikh et al. (2006), technological innovation is only referred to as innovation in products and process that are differentiated with organizational or administrative innovation. Such a definition on technological innovation is also well described in OECD (1997) below:

“Technological product and process (TPP) innovations comprise implemented technologically new products and processes and significant technological improvements in products and processes. A TPP innovation has been implemented if it has been introduced on the market (product innovation) or used within a production process (process innovation). TPP innovations involve a series of scientific, technological, organizational, financial and commercial activities.

The TPP innovating firm is one that has implemented technologically new or significantly technologically improved products or processes during the period under review.” (Oslo Manual, 1997, p. 31)

In association with internal and external factors of firms to accelerate their technological activities, studies of personnel and organizational management have explored those in a general nature, a culture, a geographical location, a networking of the firm and so on. Meanwhile, studies of corporate finance have tried to find the answer in financing sources. In general, financing to support technology innovation activity (TIA, hereafter) of firms is categorized into two sources of internal and external financing. Unanimously, several literature address that internal financing via retained earnings makes a positive impact on TIA of firms (e.g. Branch, 1974; Switzer, 1984; Himmelberg and Petersen, 1994; Brown, 2000; Hall, 2002; Beneito, 2003 among others). However, literature associated with a relation between external financing and TIA of firms report mixed results because the external financing of firms has various properties depending on its sources.

Specifically, external financing of a bank loan demands official information such as an investment plan and a financial status from firm managers whereas that of a securities (bond or stock) issue does not. Banks may alleviate not only managers' moral hazards but also agency problems

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between managers and creditors through a grading function *ex ante* and a monitoring role for their firms *ex post*. Banks make their decisions for loans for firms' projects with their loans criteria, which are usually established based on their past experiences and knowledge. The criteria may be considerably useful for routine projects of firms. However, for new and risky projects of firms beyond banks' experiences and knowledge, the criteria have a limitation that discourages managers who are willing to invest in innovative projects and even deters them from the projects themselves (Scherer, 1984; Rajan and Zingales, 2003). Dewatripont and Maskin (1995) also argue that banks are reluctant to flow their money into uncertain and risky TIA. Along a similar vein, Stulz (2001) argues that banks are inclined to be conservative in their lending decisions on risky projects of firms because they are under capital constraints such as a reserve fund for payment. Banks of relationship financing also tend to monitor subordinates related to research and development (R&D) tasks that lead TIA as well as a chief executive officer (CEO).

Meanwhile, CEOs who finance the capital needed for TIA via direct financing have larger managerial discretion (Baumol, 2001) in general. A remarkable study of Rajan and Zingales (2003) also address that indirect financing via bank loans is more effective to firm managers focusing routine projects whereas direct financing of security issues is more beneficiary to managers seeking for innovative technological activities as it gives them greater discretion for an investment decision on TIA. Moreover, the latter has a merit that strongly inspires managers to invest in TIA with great potential although the TIA is uncertain and risky since they are free from a rejection of a loan or a reloan from banks. The theoretical or conceptual discussions above imply a possibility that the impact of external financing on TIA of firms could be differentiated by its sources in an empirical perspective as well. Unfortunately, the previous studies targeting firms in advanced countries such as Germany, the UK and the US mostly explore the effects of internal finance on TIA although they do an effect of equity external financing on it. So, to fill up the lacuna to the literature, our study aims to examine various effects of external financing subdivided into three different types of bank loans, bond and stock issues on TIA proxied by R&D expenditures of firms in Korea, one of leading emerging economies. A significant body of studies in innovation management and economics has commonly used the R&D expenditures as a feasible proxy for the innovative technological activity of firms. In practice, private firms' R&D expenditures also represent an input for creating their sustainable profits in an innovative production function as an effort of firms seeking for technological innovation (e.g., Grabowski and Mueller, 1978; Ben-Zion, 1984; Griliches, 1986; Chauvin and Hirschey, 1993; Cohen et al., 1987; Bosworth and Rogers, 2001; Hirschey and Weygandt, 1985; Toivanen et al., 2002 among others).

In general, firms in high tech industries may be lagged behind rivals without R&D investments for the development of new technology and products due to a fast innovation speed in their field. So, they are inclined to further invest their efforts for the development of a high technology. In such a vein, by subdividing the full sample into high and non-high tech firm groups, we also explore a difference for the impacts of the three types of external financing on TIA. In addition, to account for uniqueness of the *chaebol* oriented Korean economy, we also examine whether there is a difference between *chaebol* affiliated firms and non-*chaebol* affiliated firms for effects of various external financing on TIA. Many of the Korean firms belong to a business group known as *chaebols*.<sup>1</sup> This property of

Korean *chaebol* affiliated firms may enable us to draw insightful implications for relationship between external financing and Korean firms' TIA.

Principal findings from our study are: this paper indicates evidence that external financing via bank loans makes a negative impact on TIA of Korean listed firms whereas the financing via security (bond or stock) issues does a positive one on it. The results support the hypothesis of manager discretion that banks' conservative lending criteria which demand considerable collaterals from firms discourage managers from investments in TIA with high risk-high return. Meanwhile, external financing of security issues grants managers discretion for their TIA. Regarding the subsamples, external financing of security issues makes no effect on TIA of high tech group firms and that of bank loans does no effect on TIA of *chaebol* affiliated firms.

This paper is structured as follows. Section 2 reviews the previous literature. Section 3 describes data issues for this study. Section 4 specifies a research model and hypotheses. Section 5 discusses empirical results. The conclusion is in Section 6.

## 2. Literature

External financing of a bank loan demands official information such as an investment plan and a financial status from firm managers whereas that of a securities (bond or stock) issue does not. Banks may alleviate not only managers' moral hazards but also agency problems between managers and creditors through a grading function *ex ante* and a monitoring role for their firms *ex post*. Banks make their decisions for loans for firms' projects with their loans criteria, which are usually established based on their past experiences and knowledge. The criteria may be considerably useful for routine projects of firms.

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Regarding the empirical studies for the issue, Hall (1990) and Bhagat and Welch (1995) targeting USA firms report evidence that an increase in leverage ratio in the previous fiscal year, due to an external financing activity, decreases R&D expenditures of firms in the fiscal year. On the other hand, the recent study of Brown and Petersen (2011) address that debt issues of US manufacturing firms make no significant effects on R&D investments of firms but instead, internal liquidities (i.e., cash holding) in firms are a crucial factors for increasing the R&D efforts of firms. By contrast, Bhagat and Welch (1995) suggest that TIA and leverage of firms have a positive relationship. In the recent time, Muller and Zimmermann (2009) find that equity external financing has a positive influence on R&D activities of innovative firms in Germany particularly.

<sup>1</sup> The Korean *chaebols* have many affiliates tied by a nexus of explicit and implicit contracts and connected by an extensive arrangement of reciprocal shareholding agreements under its wing (Baek et al., 2006). Korean *chaebols* are often compared to Japanese *keiretsus* with many similarities wing. However, the most distinction between Korean *chaebol* and Japanese *keiretsus* is if they have families in control. That is, the former has such families but the latter has never had them after the World War II. Korean *chaebol* affiliates make decisions for investment and financing decisions and for an allocation of funds to serve group-level purposes and thus create an explicit internal capital market (Bae et al., 2011). In addition, compared to non-*chaebol* affiliated firms, *chaebol* affiliated firms also enjoy a further advantageous position for various external financing due to higher collaterals and credit ratings in the Korean economy (Kim et al., 2004). See Cazorra (2006) for the comprehensive review on various business groups in the world economy.

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