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Financing constraints and investments in R&D: Evidence from Indian manufacturing firms

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ABSTRACT

This study examines the extent to which financing constraints affect the research and development (R&D) expenditure of Indian manufacturing firms during the period 1991–2011. Using dynamic R&D investment model, we find significant positive relationship between a firm's R&D expenditure and internal cash flow. We lend support to the financing constraint hypothesis by showing higher cash flow sensitivity for small and young firms. Further, we explore the effect of business group affiliation and financial market liquidity on the relationship between financial factors and investments in R&D. We fail to find any significant advantage for group-affiliated firms, indicating ineffectiveness of business groups in alleviating financial constraints. Further, we observe that sample firms do not use external equity to finance their R&D even during periods of hot-equity market and are not engaging in R&D smoothing using cash reserves.

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1. Introduction

The recent growth theories highlight the role of R&D investment in promoting economic growth (Aghion & Howitt, 1992). However, the investment in R&D is riddled with information problems and lack of collateral value due to the uncertainty involved in R&D activities (Hall, 1992). Therefore, frictions are likely to arise in the case of obtaining external financing for R&D. This issue becomes severe in the case of developing countries due to the under-developed capital markets and opaque financial reporting practices. Thus, financing constraints are likely to hamper the economic growth especially in the case of emerging economy like India.

Since the onset of economic reforms in 1990, Indian firms are increasingly focusing on global competitiveness by way of innovation. A number of multinational corporations have set up their R&D centers in India. Indian companies are entering into research

collaborations and alliances with global firms. Successive Science, Technology, and Innovation Policies–2003 and 2013 propose an increase in gross expenditure on R&D (GERD) to the extent of 2% of GDP. However, GERD to GDP has not undergone any significant change since nineties. The GERD on GDP for India is only 0.76%, which is substantially lower than China's figure of 1.76% (Global Innovation Report 2013). This has led India to dismal 66th position in the Global Innovation Index 2013 rankings. A plausible reason for the non-translation of vision into reality is the lack of efficient financing of R&D (Mani, 2009). Underdeveloped financial system in India may hamper financing of R&D and are likely to reduce the growth momentum in the economy. Despite the long history and the presence of stock exchanges in India, the liquidity³ in equity market is thin and corporate bond market is virtually non-existent. As observed by Allen, Chakrabarti, De, Qia, and Qian (2012) "the size and role of the capital markets in allocating resources have been limited in India, as in many other emerging economies" (p. 416).

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E-mail addresses: subash@iitm.ac.in (S. Sasidharan), jijo.lukose@gmail.com(P.J. Jijo Lukose), surender@ifmr.ac.in, surenderrao@gmail.com (S. Komera).¹ Tel.: +91 44 2257 4507; fax: +91 44 2257 4502.² Tel.: +91 495 2809100; fax: +91 495 2803010.³ India ranked only 22nd in terms of turnover ratio (value traded divided by market capitalization) as of December 2010 (National Stock Exchange Fact Book, 2011).

Further, banking sector in India is under-utilized and does not provide much credit to the corporate sector.⁴ Therefore, we conjecture that given the intangible nature of the R&D investment and underdeveloped nature of capital markets, internal finance is going to be the major determinant of R&D in India.

Numerous studies from developed markets analyzing the determinants of propensity and extent of R&D highlight financial factors as the crucial driver of R&D (Bhagat & Welch, 1995; Bond, Harhoff, & Van Reenen, 2005; Czarnitzki & Hottenrott, 2011; Hall, 1992; Singh & Faircloth, 2005). Absence of studies pertaining to the role of financing constraints in explaining R&D investment in the context of emerging economy viz. India, is the primary motivation for the present study. In this paper, we examine four main issues related to financing of R&D investments in the Indian context:

1. Examine the relative importance of internal cash-flow and external financing (debt and equity) in determining R&D expenditure?
2. Does affiliation with a business group alleviate financing constraints by way of reduced importance of internal cash-flow?
3. Do R&D intensive firms engage in the R&D smoothing using cash reserves as evidenced by a negative relationship between change in cash holdings and R&D investments?
4. How does liquidity in the equity market affect R&D investment of Indian firms?

Our empirical analysis is based on a rich firm level data of listed firms belonging to the Indian manufacturing sector during 1991–2011. In order to investigate the role of financial factors in R&D investment expenditure, we use the modified dynamic R&D model developed by Bond and Meghir (1994). This model is extended by including variables such as debt financing, equity financing and change in cash-flows. The estimation is carried out using the ‘systems’ Generalized Method of Moments (GMM) estimator. In a panel setting, the systems GMM estimator has an added appeal that it accounts for the firm specific effects and the potential endogeneity problems. Our empirical analysis provides support for the role of cash-flows in explaining firms’ R&D investment expenditures. Further, we do not find any evidence of R&D smoothing by Indian firms.

Our contribution to the growing body of empirical literature on the financing of R&D activities is threefold. *First*, to our knowledge, no previous studies examined the role of internal finance on R&D investments in the context of India. As highlighted above, India as an emerging market economy offers a number of peculiarities in order to test the role of internal finance in R&D. Further, the dataset employed for this study spans over two decades following the liberalization since the nineties. The data availability for 20 years permits rigorous statistical analysis.⁵ India, being a country with one of the largest number of listed firms in the world provides an ideal testing ground for validating the impact of financial constraints on R&D. *Second*, we examine the impact of collapse of capital market on R&D investments. Specifically, we consider the impact of two major liquidity shocks witnessed during the study period. These shocks were the collapse of India’s equity market in 1997 (Gopalan & Gormley, 2013) and the recent financial crisis in 2008 respectively. By undertaking such an exercise, we contribute to a recent debate about the cyclicity of R&D (see Aghion, Askenazy, Berman, Cette, & Eymard, 2012; Barlevy, 2007). Further,

a unique feature of India’s corporate ownership structure is the existence of business groups (Khanna & Yafeh, 2007). It is often argued that business groups have internal capital markets that will reduce financing frictions. This warrants an in-depth analysis on the role of ownership structure of firms on financing choices of R&D. Therefore, we investigate the impact of ownership structure on cash-flow sensitivity by classifying the sample firms into group-affiliated, foreign, and stand-alone firms⁶; since this may be decisive factor in alleviating financial constraints given the weak institutional development.

The paper is organized as follows. Section 2 provides the theoretical background and the relevant literature. Section 3 provides empirical specification and details of the estimation methods. Section 4 presents the data source and summary statistics. Section 5 discusses the empirical results. Section 6 concludes.

2. Theoretical underpinnings and literature review

The capital market imperfections are found to affect the investment decisions of a firm (Hubbard, 1998). These imperfections arise due to the asymmetric information and agency problems between managers and investors (Myers & Majluf, 1984; Stiglitz & Weiss, 1981). These will lead to difficulties in obtaining funds for investment in physical and intangible assets, especially in the case of financially constrained firms. In fact, the effect of financial constraints is more pronounced in the case of investments in R&D. The very nature of the R&D namely – riskiness, uncertainty, and absence of collateral together act as barrier for financing such projects (Hall & Lerner, 2010). Czarnitzki and Hottenrott (2011) in their empirical investigation show that the internal funds are more decisive for financing R&D investments than for capital investments. Further, Bhattacharya and Ritter (1983) emphasize that firms are hesitant to fund their R&D projects using external funds because of the possibility of disclosing the content of their innovation to the market. Therefore, the investment in R&D must be undertaken using the firm’s internal financial resources.

In the presence of frictionless capital market, a reduction in cash-flow will not affect the investment since the firm can obtain funds from external sources. Several empirical studies since the pioneering work by Fazzari, Hubbard, and Petersen (1988) investigated the role of financing constraints by testing whether cash-flows affects fixed investment after controlling for investment opportunities. This methodology was further extended to analyze the role of cash-flows on R&D investments. The commonly employed methods for modeling investment behavior are standard reduced form of an accelerator and/or error-correction specifications (Bond, Elston, Mairesse, & Mulkey, 2003; Fazzari et al., 1988) or Euler equations (Bond & Meghir, 1994). Previous empirical studies examining the role of financial frictions on R&D intensity augment the above models with contemporaneous cash-flow and other financial factors as additional variables. In the absence of financing constraints, R&D investment will not be sensitive to financial factors. More recently, the studies have adapted direct approach by supplementing financial statement information with the other instruments like credit ratings and direct surveys in identifying the potentially financially constrained firms (Czarnitzki & Hottenrott, 2011; Savignac, 2008; Silva & Carreira, 2012). However, there are some apprehensions about direct approach as it may lead to biased results since respondents may overstate ‘lack of finance’ if they are investing more in R&D projects (Czarnitzki & Hottenrott, 2010).

⁴ It is interesting to note average bank credit/GDP ratio for the other emerging economies (0.65) is almost two times that of India (Allen et al., 2012).

⁵ Some of the recent studies such as Brown et al. (2012) focus on the experience of listed firms in the US and European countries.

⁶ We follow the classification provided in PROWESS database to identify the ownership category.

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