



Debt and communications technology diffusion: Retrospective evidence



Sumit K. Majumdar

University of Texas at Dallas, 800 West Campbell, Richardson, TX, United States

ARTICLE INFO

Article history:

Received 18 September 2012

Received in revised form

27 September 2015

Accepted 13 October 2015

Available online 1 December 2015

Keywords:

Broadband technology

Corporate debt

Bonds

Digital technology

Technology financing

Institutional logics

Leverage

United States Telecommunications Industry

ABSTRACT

This study has evaluated the relationship between debt in the capital structure of firms and the dynamics of broadband and digital technology adoption in the United States, based on a large dataset on local exchange carriers in the United States over a contemporary historical fourteen year period from 1988 to 2001. Using treatment effects modeling, the impact of debt in impacting the levels of firms' broadband deployment has been found to be negative and significant. The primary source of debt in the sector has been in the form of arm's-length corporate bonds and the assumptions of the monitoring hypothesis associated with such debt, that lenders, in the face of information and collective actions problems, might not be able to control managers and hence invest less in highly technology-intensive situations, are supported by the data. Additionally, the data set has been split into separate sets for two periods, one between 1988 and 1995, for the period before the Telecommunications Act of 1996 came into force, and the other set between 1996 and 2001, and the results have stayed consistent. A test of the coefficients between the two periods has shown that the negative impact of leverage on broadband deployment has become stronger after the introduction of competition in the sector, and this has suggested that the change in the institutional logics between the two periods has been of material impact in influencing lenders' perceptions.

© 2015 Elsevier B.V. All rights reserved.

1. Introduction

How financial concerns have impacted on firms' technology performance is important¹. As industrial nations become knowledge economies, how technology and innovations have been financed have become a relevant public policy, corporate finance and strategic management issue², since technology adoption is the key to productivity (Aghion and Howitt, 1992). Countries' financial sectors have been based on debt or equity markets, and debt has been an important funds source for firms (Corbett and Jenkinson, 1997)³.

E-mail address: Majumdar@utdallas.edu

¹ See Bencivenga and Smith (1991), Cantor (1990), Hall (2002), Hao and Jaffe (1993), King and Levine (1993), Lang et al. (1996), Mayer (1990) and O'Brien (2003).

² Corporate finance and governance issues influence innovativeness. Equally, the link between financing and growth is important. For example, the development of financial markets in England had been a precursor for the industrialization of England (Hicks, 1969).

³ With economic growth, debt financing has become important. The importance of debt or equity financing depends on a country's industrialization stage (Abramovitz, 1986; Gerschenkron, 1965). In early industrialization, investment financing came from retained earnings (Hall, 1994) or equity markets (Lazonick and O'Sullivan, 1997). In South Korea banks have been important (Amsden, 1989), and bank

In modern economies, the defining feature of the two components of a firm's capital, debt and equity, have been the differential rights of their providers (La Porta et al., 1998). The relationship between firms' capital structure and strategy has been considered important⁴, with the capital structure of firms being measured by the leverage or the debt to equity or the debt to total assets ratio (Zingales, 1998). Debt has been defined by a fixed promised stream of interest payments, and equity has entitled owners to receive dividends. Debt holders have had the right to repossess collateral, which are often the tangible assets of the enterprise, if managers' actions have bankrupted the firm. Equity holders could vote out managers and directors who have not acted in best interests⁵.

financing has been suggested as a development strategy for other nations (Aoki and Patrick, 1994).

⁴ See Brown et al. (2009), Campello (2003), Kochhar and Hitt (1998), Ivashina et al. (2009) and Kovenock and Phillips (1997).

⁵ The exercise of rights depends on history, formal rules of the jurisdiction in which equity and debt holders are located and the way in which rules are implemented. The way in which a firm's debt and equity composition impacts on strategies depends on the location context of the firm.

The extent of debt could materially impact firms' behavior, in either direction, because interrelationships between financial and strategic decisions have been close⁶. These interrelationships, between capital structure and strategy, have tightened with new markets' emergence. In infrastructure sectors, institutional changes have led to changes in firms' capital structures. In the telecommunications sector, with the opening-up of markets, borrowings by firms, to fund spectrum acquisitions, mergers or network modernization activities, have increased. Such debt increases have caused concern that high leverage could imply greater financial distress risk, transferring of such risk to consumers, and the public, and constrain the future growth and financing of the firms providing communications technology infrastructure (Bortolotti et al., 2011)⁷.

Yet, modern communication infrastructures could contribute to economic growth. Communications technologies, as general purpose technologies (Lipsey et al., 2006; Majumdar, 2008)⁸, could enhance firms' performance⁹. The enhancements of capabilities via better equipment could change service delivery possibilities, provide universal connectivity and enhance dynamic efficiencies¹⁰, an important outcome measure in competition policy (Brodley, 1987). Hence, whether firms' leverage levels have been important in impacting levels of communications technology deployment has become an important policy issue.

Based on a large, publicly-available, historical dataset of United States incumbent local exchange carriers (ILECs), and based on retrospective analyses, the question of whether firms' leverage levels have impacted levels of technology deployment has been evaluated for a panel of firms for a fourteen year period from 1988 to 2001. Given a relatively extensive panel data set, two-way dynamic causality relationships between debt levels and technology levels have been evaluated, as relative debt levels could influence greater technology adoption, and, conversely, greater technology adoption levels could influence firms' borrowing levels. Mutual influence attribution requires assessment, and statistical causality analysis has permitted this. In addition, the endogeneity of the debt variable has been dealt with by estimating relationships using treatment effect models.

This period has been important in the sector for institutional reasons. Retrospective analyses allow assessment of whether the

institutional environment has influenced the generation of positive outcomes. The assessment is contextualized for two unique institutional periods, within the overall 1988 to 2001 time-period, in which sector regulatory and competitive conditions, and sector institutional logics, substantially changed¹¹. On a theoretical plane, the relationship between leverage and technology levels has been evaluated for a network industry in which the type of business, the nature of technology deployed, and the nature of possible collateral on offer, would play roles in influencing lenders' decisions.

The article contributes further by evaluating the relationship across two unique time periods in the sector, in which distinct institutional logics prevailed. Comparative retrospective analysis is important. Firms' motivations differ across time (Nelson, 2007), as institutions shape incentives by determining the distribution of resources, influencing investments and impacting property rights (North and Thomas, 1973). Strategic behavior is influenced by institutions (North, 1990), and these influence decision-making by their logics that shape behavior (Thornton and Ocasio, 2008; North, 2005). Such a theoretical assessment is important, as the literature has not dealt adequately with comparative retrospective analysis, taking into account historical contingencies, in analyzing the impact of institutional features in determining competition policy regime outcomes to evolve optimal policy designs (Sokol, 2010).

The present article builds on several other related works on firms in the sector¹², and unfolds as follows: how financing may affect contemporary communications infrastructure asset creation is discussed. Then, the context of the study and the empirical details are discussed, with, thereafter, the links between how debt levels may influence communications technology adoption also discussed. The section that follows contains details of the statistical modeling carried out. The results obtained from the analysis are then discussed. The final section concludes the article.

2. General theory on debt and technology diffusion

Several pieces, starting with Myers (1977), have evaluated the choice of different types of debt by firms. For technology-intensive firms, the control rights approach (Hart, 1995) has suggested that the presence of technology assets could lead financiers to seek control of firms' operations. Thus, technology-intensive firms might choose to fund projects via internal rather than external resources (Himmelberg and Petersen, 1994). Such technology-intensive firms might favor lower leverage (Calomiris et al., 1997; Cantor, 1990; Lang et al., 1996; Singh and Faircloth, 2005), and empirical work has shown that debt levels and technology intensities are negatively related¹³.

Relative debt levels could also influence technology deployment via the monitoring aspect. Firms might borrow from two types of lenders. Banks and financial institutions would be private lenders. The public-at-large would subscribe to corporate bonds and debentures. These would be outsiders or arms-length lenders. Public debt and bond issues would be hands-off transactions with few interactions occurring between financiers and borrowers (Berlin and

⁶ See Balakrishnan and Fox (1993), Barton and Gordon (1987), Bettis (1983), Bromiley (1990), Parsons and Titman (2008) and Oviatt (1988).

⁷ A generation ago, in 1989 the public utilities sector in the accounted for approximately 6 percent of the gross national product and 19 percent of capital expenditures (Spiegel and Spulber, 1994). With the spread of the Internet, these relative amounts have jumped substantially.

⁸ See Crafts (2004) and Lipsey et al. (2006). See also Majumdar (2008) and Majumdar et al. (2010) for full details on these issues, and from which this section has been extracted.

⁹ The impact of information and communications technologies occurs in firms because of equipment and associated changes in production and work organization (Bresnahan, 1999). Dynamic efficiency forces are evolutionary (Kolasky and Dick, 2003). They result from temporal processes leading to lower costs and new and improved products and services. These processes, encapsulating dynamic evolutionary forces, include technology deployment, diffusion and innovation. These processes change ways of doing business, and these can be incorporated into current operations and business models. The modified business models lower costs, and generate new products and services (Gotts and Rapp, 2004), through reconfigured capabilities.

¹⁰ Within the communications sector, as an example take broadband technology. Broadband as a general purpose technology augments customer functionalities (Firth and Mellor, 2005). The general purpose nature of broadband implies that individual users can use the network for multiple purposes. Broadband transforms the composition of the local loop network (Hatfield et al., 2005) and the consumer benefits from broadband deployments are large (Bauer et al., 2003). Broadband enables connectivity, the carrying out of transactions efficiently, is an instrument to develop new activities (Bertschek and Kaiser, 2004), and raises network capacity (Preissl, 1995).

¹¹ Historical contingency characterizes an institutional logics approach (Thornton, 2001; Thornton and Ocasio, 2008). The behavior of individual firms in a national setting evolve along different paths, at different times, due to institutional variations (North, 1994), and theories of behavior are particular to historical time and cultural environments (Thornton, 2004) as each firm's context is unique (Dosi and Marengo, 2007).

¹² See Majumdar (2008, 2011a,b) and Majumdar et al. (2010) for numerous further details.

¹³ See Balakrishnan and Fox (1993), Friend and Lang (1988), O'Brien (2003) and Vincente-Lorente (2001).

Download English Version:

<https://daneshyari.com/en/article/10482862>

Download Persian Version:

<https://daneshyari.com/article/10482862>

[Daneshyari.com](https://daneshyari.com)