Factors Influencing the Performance of Indian and Chinese Software Firms

N.S. Siddharthan
Madras School of Economics and Forum for Global Knowledge Sharing
http://knowledgeforum.tifac.org.in
nssiddharthan@gmail.com

Stanley Nollen
Georgetown University, McDonough School of Business
Old North Building G07, 37th & 'O' Streets NW
Washington DC
Tel: 1 202 687 3826; Fax: 1 202 687 4031
nollens@georgetown.edu

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International Alliances and the Performance of Indian Software Firms

Abstract

IT software sectors of India and China are large and are growing at a phenomenal rate. However, while the Indian software industry is mainly export oriented (exports accounting for more than 80% of sales), the Chinese software sector is mainly domestic. This paper analyses the determinants of growth and profit behaviour of the Chinese and Indian IT Software firms. The study shows that the number of non-equity strategic alliances the Indian firms had with the US and European firms, labour productivity and manager's experience mainly influenced the growth of the Indian firms. In the case of the Chinese firms their growth depended mainly on capital intensity of production, the role played by the overseas Chinese, entrepreneurial orientation of the managers, and quality certification received by the firms. Profits of the Indian firms also depended on non-equity strategic alliances and linkages with overseas non-resident Indians. Profits of Chinese software firms depended mainly on their R&D expenditures and quality certifications received. In the case of Indian firms the role of non-resident Indians and technological capabilities influenced mainly profits and not growth while in the case of Chinese firms networking with overseas Chinese influenced growth and not profits.

International Alliances and the Performance of Indian Software Firms

The Indian software industry has grown rapidly since the early 1990s, and reached $30.3 billion in total revenue in 2005-06. Most of the growth was achieved by exports, for which the compound annual growth rate (CAGR) exceeded 40% over the long period from 1990-91 to 2004-05 (*Dataquest* 2005, NASSCOM 2007) (see Table 1). Software is India's single biggest export earner, and Indian software services exports exceed those of all other countries. The domestic market has also experienced rapid growth in the last two years, although it remains absolutely quite small.

The Chinese software industry is probably even bigger in size, with an estimated $26.4 billion in sales revenue in 2004, and it was nearly as fast-growing over this period.[i] While the two countries' software industries are similar in size and growth rate, they differ dramatically in the markets they serve: most Indian software is exported (nearly 80%) while most Chinese software is domestically purchased (more than 90%). Furthermore, most Indian software is customized software services (more than 90%) while Chinese software is oriented to packaged products (more than 40%).

This paper analyses the determinants of the growth and profit behaviour of the Indian and Chinese software firms.

Growth and Profit

We explain the performance of firms in the Indian and Chinese software industry with two different but related measures: growth and profit. Growth refers to change in sales revenue, and profit refers to profit margin, which is gross profit relative to sales revenue, or return on sales.[1] The standard texts of managerial models of the firm (Hay & Morris 1991, Marris 1964, 1971) consider growth and profit to be endogenous variables and develop an inverted U-shaped growth-profit frontier. According to these theories, growth and profit objectives for a firm could move together, but beyond a certain point further growth requires some sacrifice of profit. This is consistent with the objective of growth maximization subject to a profit constraint. Following the standard managerial models, we utilize both growth and profit in the analysis of software

[1] Other measures that refer to profit rate such as return on assets or return on equity are not suitable for this study because physical capital is not an important input in the software industry, and many software firms are not listed on any stock exchange.

firms because both are especially important for firms in high technology industries. Managers of firms have incentives to achieve fast growth as well as high profits because under-utilised indivisible resources are likely to be present in small- and medium-sized project-oriented firms, which describes most Indian software firms, and top management compensation systems often reflect both outcomes. In any case, the two goals are not different if projects to be undertaken are profitable. Therefore to explain both growth and profits gives a broader picture of the firm's performance than using either one alone.

To achieve faster growth the firm must diversify into new products or new markets (Hay & Morris 1991; Marris 1971, 1964). To do so requires innovation to create new products and marketing to promote them (lower prices for old products can only raise short term growth). For international growth, it also requires linkages abroad. However, innovation and marketing incur costs, and so it is not clear whether profit margins rise or fall. In the early stages starting at low growth rates, growth and profit can be directly related and both achieved at the same time as the easier and more profitable diversification opportunities are exploited. After that faster growth is associated with lower profit margins unless the firm can shift its growth-profit frontier out sufficiently to overcome the higher costs of faster growth. Managerial capacity is a potential constraint and a cost of growth. Faster growth requires more managers with the result that managers' experience might be less. (Finance can also be a constraint, but it is not likely for software firms whose financing requirements are modest, retained earnings is a source of finance, and entry is quite easy.)

Firms can grow via vertical integration, which can be achieved by organic growth, acquisition, or non-equity strategic alliances as alternatives to direct investment. In the case of the worldwide software industry there are large numbers of upstream suppliers (located in India, Ireland, Israel, China, and other countries) that operate in competitive markets, and therefore downstream firms (located in North America, Europe, and Japan) are likely to be willing to enter into contracts with these suppliers. This enables faster growth via new markets for the upstream software suppliers.

The growth-profit frontier can also shift out because of factors in the business environment external to the firm, such as changes in government policies, national income growth, and shifts in technology. These external forces impinge on all firms equally in a single-country, single-industry study, unless the industry definition is broad and encompasses different

lines of business with different production technologies and income elasticities. However, firms can differ in the extent to which they take advantage of changes in the external business environment or become victims of the changes. For example, technological shifts in the industry need to be adapted to the firm's use and implemented, which requires managerial capabilities and incurs costs. If a firm fails to take advantage of changes in the business environment, it will not achieve both faster growth and greater profitability as it falls behind its rivals in the industry.

The foregoing analysis focuses attention on several sets of potential determinants of growth and profit: the innovation and technology activities of the firm, the capacities and quality of the firm's management and labour, and its international linkages, in particular its non-equity strategic alliances. We use multiple indicators for each of these sets of variables to explain the growth in sales revenue and profit margin of the firm in separate analyses of each. To account for the relationship between growth and profit, either positive or negative, we experiment with including the firm's profit margin as an endogenous right-hand side variable in the growth equation, and with including the firm's revenue growth as an endogenous right hand side variable in its profit margin equation, each in a two-stage least squares analysis.

International Linkages: The Role of Alliances

Both theoretical arguments and empirical evidence in recent years demonstrate the importance of networks and strategic alliances to the competitive success of firms. The case for non-equity strategic alliances appears especially persuasive for software firms. Alliances enable firms to gain access to complementary resources that are difficult to build organically, and they lend legitimacy and status, which is especially important for new and small firms (Baum, Calebrese & Silverman 2000). Alliances enable firms to create value that cannot be achieved by either alliance partner acting alone (Holm, Eriksson & Johansson 1996). The strategic attributes that a foreign partner brings, especially marketing and technology, bolster firm growth, especially for firms that are deficient in these attributes (Luo 2002), as Indian firms are. Collaborations can result in technological innovation and the creation of new products and services via knowledge sharing (Dyer & Singh 1998). For international growth, alliances allow firms to learn about foreign markets; they offer a shortcut for inexperienced firms to enter markets abroad (Yusuf 2004). Non-equity alliances avoid the need for large upfront capital investments and negotiations with foreign governments about the terms and conditions of market

entry. They can be implemented quickly, which is especially important in a fast-growing and rapidly changing industry.

Several empirical studies support these theoretical claims. Alliances, networking, or cooperative agreements were found to contribute to the performance and competitive success of a firm in several studies (Dyer & Nobeoka 2000; Chetty & Holm 2000; Eriksson & Chetty 2003; Forsgren & Johansson 1992, Riccaboni & Pammoli 2002). In global production networks, alliances played a crucial role for contract manufacturing (Ernst 2004). In particular, alliances contributed to the growth of firms via geographic extension into new markets (Haynes & Senneseth 2001), and the internationalization of software firms in particular depended on networking (Oviatt & McDougall 1994). The marketing, technology, and managerial skills of foreign partners contributed to the performance of Chinese industrial firms (Luo 2002).

It is not only the number, but also the type of alliance that influences the firm's performance. Alliances with market leaders that gave legitimacy and credibility to young firms – reputational alliances – reduced the time required for start-ups to reach break even (this performance outcome contains elements of both growth and profits) among high-technology firms in German-speaking Europe, and both reputational and marketing alliances contributed to start-up firms' sales revenue (Lechner, Dowling & Welpe 2006). In another recent study, a new firm's network capability, which measures the extent of coordination, communication, relational skills, and partner knowledge, influenced its sales revenue growth positively (Walter, Auer & Ritter 2006). These findings, although not from the software industry, surely apply to it. Indian software firms intent on international growth by export need both reputational and marketing resources. In a study of Chinese equity joint ventures, firms with more cooperation reported better performance, including revenue growth and profitability (Luo & Park 2005).

In the software industry alliances and networking are commonplace. From the standpoint of Indian software firms, non-equity alliances are typically vertical downstream alliances. The Indian firm is frequently an outsourced supplier of customized software services for an American producer of software platforms installed for end-user customers. They are supply chain partnerships whose motives are cooperative specialization and market access (Contractor 2005). In this context, alliances facilitate international growth via any of four mechanisms. Alliances facilitate exporting because they do not require that the partner be a large firm, they avoid the need for outward foreign direct investment into markets abroad, they do not require a large home

market from which to launch growth abroad, and they are a mechanism by which the firm can acquire complementary resources (Oviatt & McDougall 1994). All four of these advantages apply to Indian software firms. Even the largest among them were not large by international standards, they did not have the capital resources to enable sizable outward foreign direct investment, the Indian domestic market was small and not very competitive, and the firms lacked critical resources, especially marketing know-how and domain knowledge specific to any industry abroad. Accordingly many Indian software firms have large numbers of alliances, often for market access reasons, but also for technology reasons (Siddharthan & Nollen 2004b). International alliances are overrepresented as a business practice among the Indian firms: Indian software firms have more alliances (this includes joint ventures, M&As, and outsourcing agreements) with multinational corporations than would be predicted by the number of these firms compared to all firms in the industry) (Giarratana, Pagano & Torrisi 2005).

Hypothesis 1a. We expect that firms with more non-equity alliances will grow faster and be more profitable than firms with fewer alliances.

Foreign ownership is a second form of international linkage. It is theoretically a source of faster growth and greater profits. Foreign investors bring capital, technology, management, or access to foreign markets. Several previous empirical studies hypothesized a positive relationship between foreign ownership and growth, but none of them found it. The foreign ownership variable in Buckley, Dunning, & Pearce (1978) gave inconclusive results. Multinational firm affiliation had a negative sign in the study of US firms by Siddharthan & Lall (1982). For large Indian firms, Siddharthan, Pandit, & Agarwal (1994) found a negative relationship between foreign ownership and growth. The effect of multinationality on firm growth appears to be contingent, depending on the country of origin of the foreign owner (e.g., U.S. or Japanese as in Rowthorn 1971), the industry and its associated scope for international integration of strategy (Cantwell & Sanna-Randaccio 1993), and the motive for foreign ownership (e.g., expansionary versus defensive FDI; Chen & Ku 2000). It is difficult to establish a relationship between foreign ownership and growth in cross-sectional samples of firms or industries. In any event, foreign ownership is quite small among Indian software firms.

Hypothesis 1b. We do not expect foreign ownership to be a significant contributor to the growth or profitability of Indian and Chinese software firms.

A third form of international linkage is the role played by non-resident Indians (NRIs) for India and overseas Chinese (OC) for China. There are more than two million NRIs in the US, and many of them are technically educated. They might offer benefits of advanced technology, management experience, and venture capital (Radhakrishnan 2004; Arora and Athreye 2001; Balasubramanyam & Balasubramanyam 1997). They might provide a bridge from the US export customer to the Indian outsourced supplier. Their role in promoting exports by opening access to foreign markets has been emphasized (Heeks & Nicholson 2002). However, alliances consisting of social networks (personal relationships with individuals) did not contribute to any measure of performance for German-speaking start-ups (Lechner, Dowling & Welpe 2006).

Hypothesis 1c. We expect that firms that report greater benefits from the role played by non-resident Indians and overseas Chinese will have faster growth and greater profitability than firms that report fewer benefits.

Management and Labour

Firms with superior managers can more successfully introduce new products or enter new markets than firms whose managers are less capable. Limitations of managerial capacity, either from a scarcity of managers or from inexperience among newly employed managers, constrain the firm's growth. The difficulties of coordination and control in fast-growing organizations might adversely affect profits. Empirical studies support these arguments. For example, semiconductor start-ups whose top management teams had greater prior joint work experience had higher sales revenue growth (Eisenhart & Schoonhoven 1990). Among Indian software firms, previous studies suggest that the skill and ability of managers and professionals are important to explain the firm's growth, profits, and export performance. For example, managers' education and foreign expertise of employees were associated with faster export growth (Contractor, Hsu, & Kundu 2005), project management capabilities contributed to profit (Ehiraj et.al. 2004). Arora & Gambardella (2005) claim that the growth of Indian software firms in the midst of increasing competition from firms in other low-wage countries depends in part on the firms' organizational capabilities, in particular the ability to take on and manage large projects.

Hypothesis 2a. We expect firms with more educated and more experienced (including international experience) managers to be faster growing and more profitable than firms whose managers are less educated and experienced.

Software services production is skilled labour intensive – labour accounts for about 70% of total costs (Khanna & Palepu 2004) – and therefore labour productivity should be important to a software services firm's performance. Firms with greater labour productivity have been shown to be more export intensive than firms with lesser labour productivity. To the extent that export business represents either new markets or faster growing markets than domestic markets, firms with greater labor productivity should be faster growing and more profitable.

Hypothesis 2b. We expect firms with higher labour productivity to be faster growing and more profitable than firms with lower labour productivity.

In a turbulent new industry characterized by uncertainty as well as opportunity, firms with more entrepreneurial managers are likely to grow faster than firms with a less entrepreneurial orientation. Entrepreneurial managers embrace new ideas and are experimental and risk-taking. Arora and Athreye (2001) attribute the success of Indian software firms to factors such as entrepreneurial and managerial capabilities, as well as the importance of strong links with major markets. Khanna (2005) claims that an entrepreneurial orientation characterizes the Indian software industry. However, in a recent study, entrepreneurial orientation did not by itself affect the performance of high-technology spin-offs but only did so interactively with the firm's network capabilities (Walter, Auer & Ritter 2006).

Hypothesis 2c. We expect firms with a more entrepreneurial orientation to be faster growing than firms with a less entrepreneurial orientation.

Quality certifications can be important and reassuring signals to a firm's potential customers. This is especially likely for Indian and Chinese software firms, many of which are quite young and not well known, as they seek to reach new markets abroad and convince export customers of their capability and reliability. Quality certifications signal the firm's commitment to providing accountable, reliable, and error-free services; it is part of an Indian software firm's competitive strategy (Athreye 2005). To the extent that firms can demonstrate quality, they can succeed in new markets and therefore generate faster revenue growth. However, to achieve quality certification adds to cost, and it is not obvious that the firm's profitability is also enhanced. In the software industry, Capability Maturity Model (CMM) certifications are a standard measure of management processes.

Hypothesis 2d. We expect firms that have quality certifications to be faster growing than firms that do not have them.

Technology

Growth and profits depend theoretically on diversification into new products or markets, and both ordinarily depend on innovation. Although the software industry is thought to be a high technology industry, few Indian software firms were at technological frontiers until very recently. For many firms, growth came from additional outsourcing contracts to supply customized software services at the entry level of the value chain. The creation of intellectual property was not necessary and scarcely possible for these firms (Nollen 2005). However, in the most recent years, technology activity has picked up as Indian software firms begin to step up their innovative activity and earn royalties from abroad from their intellectual property (*Dataquest* 2005). The technological innovativeness of Indian software entrepreneurs has been suggested as a contributor to the firm's export growth, but a recent empirical study found no relationship (Contractor, Hsu, & Kundu 2005).

The technology activity of a firm can be measured in terms of inputs or, preferably, as outputs. We use two output indicators: the number of new products introduced by the firm, which should contribute to faster growth; and whether or not the firm received royalties or technology fees from abroad, which is a revenue source and therefore should contribute to profitability.

Hypothesis 3. We expect firms with more new product introductions to be faster growing, and we expect firms with technology fees earned abroad to be more profitable.

Controls

Size. Firms that are larger have more resources and can take advantage of more options than smaller firms. They might possess more market power than smaller firms. For these reasons larger firms might be better able to shift the growth-profit frontier outward, and they could be both faster growing and more profitable than smaller firms. However, the motivation for growth might be greater among smaller firms if scale economies are available, and smaller firms might be more flexible and better equipped to change quickly as the external business environment changes.

Studies of the growth of firms began by concentrating on the relationship between firm size and growth (Buckley, Dunning & Pearce 1978; Rowthorn 1971; Siddharthan & Lall, 1982; Siddharthan, Pandit & Agarwal 1994; Cabral 1995; Das 1995; Variyam & Kraybill 1992; Shanmugam & Bhaduri 2002). All these studies hypothesized a positive relationship between

size and growth but their statistical results showed negative relationships. Some studies reported a positive relationship between firm size and export intensity, attributing the effects of size to superior information, greater risk-bearing capacity, lower unit cost, brand names, and pricing-setting power (Krugman 1990; Glejser, Jacquemin, & Petit 1980; Bonaccorsi 1992; Christensen et al 1987). However, studies for developing countries report ambiguous results (Aggarwal 2002; Kumar & Siddharthan 1994; Patibandla 1995; Willmore 1992; Athukorala, Javasuriya, & Oczkowski 1995; Siddharthan & Nollen 2004a).

The evidence for the size-profit relationship is also mixed. While Siddharthan, Pandit & Agarwal (1994) reported a positive relationship for a sample of Indian firms, a negative relationship was reported by Shepherd (1972) for the top 231 US firms and by Kumar (1984) for a sample of UK firms.

Age. In a young industry such as Indian software, the effect of the age of the firm on its performance is hard to predict. On the one hand, firms that are older have more organizational experience that can lead to higher profitability, but on the other hand, firms that are younger might be disproportionately located in the newest and most attractive niches of the industry. Moreover, in India, older firms tend to be owned by traditional business families while newer firms tend to be started and managed by professionals who are engineering graduates (as reported in "Firm Profiles/History" section of the *Capital Line* data set). In this industry young firms started by entrepreneurs with engineering backgrounds could have an advantage.

Physical Capital. The firm's physical capital is ordinarily an important input, but in the case of software firms it is not likely to be critical and we do not expect it to affect the firm's growth or profit.

Line of Business. To the extent that firms in the industry are not homogeneous, we need to account for differences in their lines of business. In the case of software, we can distinguish between software services and software products. These businesses have somewhat different production technologies and export market opportunities.

Data and Empirical Methods

The data for the empirical analysis come from original survey research conducted by personal interviews in India and China for the International Finance Corporation of the World Bank. The sample size for India is 119 firms. The sample of firms was drawn from membership lists of five industry associations and an annual trade publication's review of each industry. The Indian

software industry consists of more than 3,000 firms, a small number of which are medium- to large-size firms that account for most of the industry's revenue, plus a large number of very small firms.[2] The sample design included all the medium-large firms and a random sample of the small firms. The response rate from software firms was 62%. Interviews were conducted in person by CII professional staff members in Bangalore, Chennai, Delhi, Hyderabad, Mumbai, and Pune.

The Chinese sample was drawn randomly from a central government statistical report that identified the population of firms in Beijing and Guangzhou, to which we added firms in Shanghai based on local interviewers' knowledge of the industry. Interviews were conducted by the Renmin University survey research unit. The sample size is 60.

Dependent Variables

- Sales revenue growth during the period 2001-2002
- Profit margin of firms in 2002 a gross profit/sales revenue

Independent Variables (all measured as of 2002 except where noted)

- Labor productivity – output/employment, $/worker
- Managers' education – percent with post graduate degree – or experience – years of experience of top manager
- % of managers with education from abroad
- % of managers with work experience abroad
- Entrepreneurial orientation – scale of three 5-point questions about top manager's perception of the company's emphasis on new processes, experimentation and alternative approaches to problem solving, and inclination to take on risky projects, obtained from factor analysis of five questions (alpha = 0.781).
- Quality – binary variable with value = 1 if the firm has CMM certificate(s) and 0 if not
- Royalties or technology fees – binary variable with value = 2 if the company received royalties or technology fees from abroad in the last three years or value = 1 if not
- New products – number of new products introduced by the firm in the past year
- Foreign non-equity strategic alliances – number of these alliances the company has
- Foreign ownership – share of foreign equity holding in total equity, percent

[2] Firms with sales revenue of more than $50 million constitute only 1% of the number of firms in the industry but together have 90% of the industry's revenue, while 90% of the firms have sales revenue of less than $3 million.

- Importance of non-residents' role – scale of the sum of four 5-point questions about the importance of benefits from access to capital, management practices, markets, and technology from non-residents (5 = very important to 1 = no benefit)
- Importance of OC (overseas Chinese) role (5=very important, 1=no benefit)
- Firm size – sales revenue in 2001
- Age of the firm – number of years since founding
- Capital/labor ratio – fixed assets divided by employment in 2001
- Line of business – binary value with value = 1 if software services and value = 0 if products

Growth and profits equations were estimated separately, first via two-stage least squares in which profit margin was included in the right hand side of the growth equation, and growth was included in the right hand side of the profit margin equation. Exogenous variables from each equation that were not specified in the other equation were the instrumental variables. When estimated, neither one of the endogenous variables was significant, so each was dropped, and the equations were re-estimated using ordinary least squares. Because growth and profit margin are related theoretically, a third estimation using seemingly unrelated regressions was used. These results are similar to the OLS results; both are presented.

Results For India

The rate of growth of sales revenue in the measured one year period is both rapid and variable across companies, with a mean of 31.2% and standard deviation of 163 (Table 2). The mean profit margin, which is 16.7%, is also quite variable with standard deviation of 31.2. These data contain substantial idiosyncratic and perhaps unsystematic variation that will be difficult to explain, and yet we do obtain statistically significant results that have useful interpretations. The advantage of using a one-year growth period is that there is little or no change in the macro environment faced by firms (e.g., regulations, fiscal policies, export market growth) that could affect firms differentially but that cannot be measured with values specific to firms. The median size of firm in terms of revenue in 2002 was $6.5 million, and the main line of business for 76 percent of the firms was software services.

Determinants of Growth

Indian software firms that have more non-equity strategic alliances with foreign firms are faster growing than firms with fewer alliances – this is the important international linkage for the firms in this industry (Table 3, columns 1 and 2). Furthermore, Indian software firms that have

higher labor productivity have faster revenue growth. This result occurs when both the capital-labor ratio and the software services versus products dummy variable are entered as control variables (the latter result is not shown in Table 3). The faster growing firms also have top managers with more experience, and they have CMM quality certifications. All of these variables reflect labor and management capabilities. Size is also an important determinant of growth, with a negative sign - the larger the firm, the slower its growth rate, given other influences on growth.

Some of the variables that we hypothesized to explain revenue growth did not emerge significant in the multivariate analysis. Greater foreign ownership of the firm shows a positive relationship with growth, but the precision with which its effect is estimated falls just short of the 90% level. Likewise, the firm's innovative activity, represented by the number of new product introductions, is not significant (although positive) and therefore we cannot say that it affects the firm's rate of growth in this sample. Similarly, the entrepreneurial orientation of the firm's management, given the other management and labor influences, does not contribute further to the firm's growth (this variable was not entered in the equation shown in Table 3). Further, the firm's main line of business – software services versus products – is also not statistically significant (and hence has been omitted in Table 3).

Determinants of Profit Margin

The most important contributors to Indian software firms' profit margins are international linkages, in two ways. Firms with more non-equity alliances with foreign firms have larger profit margins than firms with fewer alliances. These alliances also contributed to firms' revenue growth. In addition, firms whose top managers report more importance from the role of non-resident Indians are more profitable than firms that receive less benefit from NRIs. Furthermore, firms that earn royalties or technology fees abroad are more profitable than those that don't. This result indicates the importance of technology outputs in the firm's profitability. The age of the firm is also a determinant of profit margin, with a negative sign. This result suggests that firms that were recently started (usually by technically qualified entrepreneurs) have performed better than older firms. As reported in the firm profiles of the C*apital Line* data set, most of the older firms were started by traditional business families and many of the newer ones were launched by persons with engineering or technical backgrounds.

The labour and management variables – labour productivity and managers' education – did not come through the multivariate analysis with significant effects on profit margins, unlike the case for revenue growth. Foreign ownership, with a positive sign, was not significant, nor was firm size, unlike the result for revenue growth.

Results for China

Table 4 presents the results of the determinants of growth and profit margins of the Chinese software firms. Unlike the case of India for the Chinese firms non-equity strategic alliances are not important and many firms don't even report such alliances. Hence, this variable is not reported in the table. On the other hand Chinese firm do have equity alliances with foreign firms. As in the case of India, in the case of China also a different set of variables emerges significant in explaining the growth and profit behaviour. Only one variable, namely, quality certificates, seems to influence positively both growth and profits. Capital intensity emerged important for the growth of Chinese firms but it was not important for determining the profit margins. This result is in line with the prediction of Marris model. In the case of India, capital intensity was not important in either the growth and profit equations. Though China has been promoting FDI in this sector, foreign ownership did not influence the growth and profit behaviour of the Chinese firms. In fact, as shown by the results, foreign firms did not enjoy higher profits in China. On the other hand, the results indicate that the overseas Chinese played an important role in influencing the growth of the enterprise. This partly explains the irrelevance of the FDI variable. In other words, it is not the links with MNEs but the links with overseas Chinese that helped the Chinese software firms. In this context it is worth recalling that in the Indian case, the non-resident Indians influenced the profits but not the growth of the Indian software firms.

In the case of technology variables, apart from technology certification, R&D costs also influenced the profits of the firms. Among the managerial variables, entrepreneurial orientation emerged important in explaining the growth but not profits. Contrary to expectations, the percentage of managers with education abroad affected growth negatively. In the case of Indian firms the percentage of managers with education or experience abroad contributed to growth positively. This could be due to the strong export orientation of the Indian firms in contrast to the Chinese firms that mainly catered to the domestic Chinese market.

Discussion of Results and Conclusions

In this study we seek to understand some of the forces that explain differences in the sales revenue growth and profit margins among firms in the Indian and Chinese software industry, using new survey research data collected for this purpose. The main difference between the Indian and Chinese firms is their orientation, namely, the export orientation of the Indian firms and the inward orientation of the Chinese firms.

The Importance of Non-equity Alliances

One factor stands out as important to both the explanation of revenue growth and profit margin: the performance of Indian software firms is better if they have more non-equity alliances. This is the central feature of the growth and profitability performance of Indian software firms. Alliances are common among these firms. In the sample for this study, 69% of the firms had them, and those firms with alliances average more than five of them. Firms with more alliances can perform better than firms with fewer alliances, we believe, because they learn how to benefit from them, thus increasing the success of the alliances, and they expand their access to export markets (Contractor 2005). The alliances were typically either marketing or technology alliances, which can contribute both to growth and profit. One more alliance contributes two percentage points to the firm's growth rate and one percentage point to the firm's profit margin, according to the estimated coefficients; each is more than a 6% gain from the average.

Is there an identification problem? Are firms that have better performance more able to secure foreign alliances? From the nature of the alliances, we think not; alliances come first, followed by growth. It is not the Indian software firm's growth, or its profit margin, that enables it to join larger western software firms as a partner. The content of the alliances, and the roles that the Indian and foreign alliance partners play, are similar across firms. A typical alliance is one in which the foreign partner provides a packaged software product or a suite of standard software services, and the Indian company provides customized software services to implement or integrate the foreign partner's product into the customer's business setting. To do so, the Indian software company accomplishes a range of tasks, ranging from programming to design (modification of the standard product) to systems integration, and in some cases, strategic consulting. (In a few cases, technology alliances have no immediate third-party customer, and instead the Indian and foreign software companies jointly create new software products.) The Indian firms obtain inclusion in the western firm's collection of alliances based on the cost and

quality of their software services; quality certifications rather than prior sales revenue growth or profit margins facilitate these alliances, we believe.

The foreign alliances are usually overlapping: typically an Indian software company has some alliances with the same foreign partners as other Indian companies. And the Indian company also has multiple alliances with several foreign firms in the same business area (for example, in e-commerce, data management, supply chain management).

Indian software firms are small by international standards, they don't enjoy a large domestic market, and they lack international marketing know-how and domain knowledge specific to international customers. Given these limitations they could not have entered the global market via the FDI route. Under these conditions they opted for networking with several international firms and forged strategic alliances, created dyadic relationships, and succeeded in generating value that could not have been accomplished by either firm acting alone. The multinational firms in turn took advantage of internet technology and established knowledge sharing relationships with Indian firms for mutual benefit.

However, foreign ownership is not important enough to make a significant difference in the firms' performance. This result is not unexpected, partly because the weight of previous empirical evidence contradicts the theoretical belief that foreign ownership should matter, and partly because the Indian software industry is largely home-grown, with a modest foreign direct investment role.

In contrast, for the Chinese firms alliances played no part. On the other hand, quality certification and entrepreneurial orientation played a crucial part.

Growth and Profit: Differences

For India in all respects other than the role of non-equity alliances, the explanation of sales revenue growth differs from the explanation of profit margin. Revenue growth depends on labour and management: labour productivity, managers' length of experience in the industry, and quality certifications that the firm achieves. Quality certifications are a signal of reliability that firms from a developing country that is distant from its potential customers need to grow faster.

Revenue growth has not seemed to depend on the firm's new product introductions. Customized software services production in a rapidly growing worldwide industry has not needed this type of innovative activity. In contrast, technological activity that produces earnings

– receipts of royalties or technology fees from abroad – does contribute to higher profit margins for Indian software firms.

The potential benefits that might accrue from non-resident Indians, mostly in the US, are realized in the form of larger profit margins for software firms, but not faster growth. In the early years of the software industry's development, when Indian firms were not well known, the access to foreign markets that NRIs could provide could have been important to their revenue growth, but no longer at the present time. The continuing contribution that NRIs can make to the management of the Indian software firm does assist their profitability.

The entrepreneurial orientation of the firm, which we expected to contribute to growth in the software industry, did not emerge as a sufficiently significant influence after other management variables were accounted for, which suggests that it is somewhat less important than the others. The entrepreneurial advantage claimed for Indian firms might not be sufficiently variable among Indian firms to explain differences in their growth. In our sample, the mean value for the entrepreneurial orientation scale was 11.2 (a high score out of 15 possible) while the standard deviation was only 2.1.

As in most previous studies, we find that firm size is negatively related to sales revenue growth, perhaps because fixed factors become a hindrance to growth in rapidly growing new industries. As expected, younger firms in our sample were more profitable than older firms.

In summary, the first important conclusion that emerges from this study of the performance of Indian software firms is that international linkages in the form of foreign non-equity alliances are important both to growth and profit margin; this is the outstanding feature of Indian software firm performance. In addition, another international linkage, which is the role played by non-resident Indians, influences profitability. Management and labour variables – labour productivity, manager's experience, and quality certifications – affect growth but not profits, while technology – royalties and technology fees received – affects profits but not growth.

For China, the results were very different from those of India. The differences in the results were mainly due to export orientation of the Indian firms and domestic market orientation of the Chinese firms. All the variables connected with international orientation like FDI, managers' job experience abroad or training abroad have either turned out insignificant or have affected the performance of the firms negatively. Overseas Chinese contributed to the growth of

firms. Entrepreneurial orientation also positively influenced the growth of firms. In sum the performance of the Chinese firms seems to be mainly dependent on quality certification and entrepreneurial orientation. Quality certification itself would depend on several factors like technology and managerial abilities in adopting technology.

In sum, the variables influencing the performance of the Indian and Chinese firms are different. The performance of the Indian firms mainly depended on their ability to forge non-equity strategic alliances with foreign firms while the Chinese firms depended primarily on obtaining quality certification. In the case of Indian firms quality certification influenced their profits but not growth. Overseas Indians helped the firms to enjoy higher profits but contributed little for growth. The opposite was true for the Chinese firms, namely, the overseas Chinese contributed to growth and not for profits. The growth of Indian firms was propelled by exports while the Chinese depended mainly on their domestic market for growth.

References

Aggarwal, Aradhna, 2002, "Liberalisation, Multinational Enterprises and Export Performance: Evidence From Indian Manufacturing", *Journal of Development Studies,*Vol. 38, No. 3, pp. 119-137.

Arora, Ashish & Suma Athreye. (2001). "The Software Industry and India's Economic Development," *Information Economics and Policy*, vol. 14 (2)

Arora, Ashish & Gambardella, Alfonso. 2005. "Bridging the Gap: Conclusions," in Arora, Ashish & Gambardella, Alfonso (eds.), *From Underdogs to Tigers: The Rise and Growth of the Software Industry in Brazil, China, India, Ireland, and Israel*. Oxford: Oxford University Press

Athreye, Suma. 2005. "The Indian Software Industry," in Arora, Ashish & Gambardella, Alfonso (eds.), *From Underdogs to Tigers: The Rise and Growth of the Software Industry in Brazil, China, India, Ireland, and Israel*. Oxford: Oxford University Press

Athukorala, Premachandra; Javasuriya, Sisira; and Oczkowski, Edward. 1995. "Multinational firms and export performance in developing countries: some analytical issues and new empirical evidence," *Journal of Development Economics*, vol. 46 (pp. 109-122)

Balasubramanyam, V.N. & Balasubramanyam, Ahalya. (1997). "International Trade in Services: The Case of India's Computer Software," *World Economy*, 20(6) pp. 829-843

Baum, Joel A.C.; Calabrese, Tony; & Silverman, Brian. 2000. "Don't Go It Alone: Alliance Network Composition and Startups' Performance in Canadian Biotechnology," *Strategic Management Journal*, vol. 21, pp. 267-294

Bonaccorsi, Andrea. (1992). "On the relationship between firm size and export intensity," *Journal of International Business Studies*, vol. 23, no. 4 (4th Quarter), pp. 605-635

Buckley, P. J., Dunning, J. H. and Pearce, R. D. (1978). The influence of firm size, industry, nationality, and degree of multinationality on the growth and profitability of the world's largest firms, 1962-1972, *Weltwirtschaftliches Archiv*, vol. 114, no. 2, 243-57.

Cabral, Luis. (1995). "Sunk Costs, Firm Size and Firm Growth", *Journal of Industrial Economics*, 43(2), 161-72.

Cantwell, John A.; and Francesca Sanna-Randaccio. (1993). "Multinationality and Firm Growth", *Weltwirtschaftliches Archiv*, 129(2), 275-99.

Capital Markets, Inc. *Capital Line* database of financial statistics of listed Indian firms. Mumbai

Chen, Tain Jy and Ying Hua Ku. (2000). "The Effect of Foreign Direct Investment on Firm Growth: The Case of Taiwan's Manufacturers", *Japan and the World Economy*, 12(2), 153-72

Chetty, Sylvie and Desiree Blankenburg Holm (2000). "Internationalisation of small to medium-sized manufacturing firms: a network approach", *International Business Review*, 9(1), 77-93.

Christensen, Carl H.; da Rocha, Angela; & Gertner, Rosane Kerbel. 1987. "An Empirical Investigation of the Factors Influencing Exporting Success of Brazilian Firms," *Journal of International Business Studies*, vol. 18, no. (Fall), pp. 61-77

Commander, Simon. 2005. "What Explains the Growth of a Software Industry in Some Emerging Markets?" in Commander, Simon (ed.), *The Software Industry in Emerging Markets*. Cheltenham UK: Edward Elgar

Contractor, Farok. 2005. "Alliance Structure and Process: Will the Two Research Streams Ever Meet in Alliance Research?" *European Management Review*, vol. 2, pp. 123-129

Contractor, Farok J.; Hsu, Chin-Chin; & Kundu, Sumit K. 2005. "Explaining Export Performance: A Comparative Study of International New Ventures in Indian and Taiwanese Software Industry, *Management International Review*, v. 45, no. 3 Special Issue, pp. 83-110

Das, Sanghamitra. (1995). "Size, Age and Firm Growth in an Infant Industry: The Computer Hardware Industry in India", *International Journal of Industrial Organization*, 13(1), 111-26.

Dataquest. (2005, 2003). vols. XXII, XX, no. 14, Special Issue (July)

Desai, Ashok. 2005. "India" in Commander, Simon (ed.), *The Software Industry in Emerging Markets*. Cheltenham UK: Edward Elgar

Dyer, Jeffery H. and Kentaro Nobeoka (2000). "Creating and Managing a High-performance Knowledge-sharing Network: The Toyota Case", *Strategic Management Journal*, 21, 345-367.

Dyer, Jeffery H. and Harbir Singh (1998). "The relational view: cooperative strategy and sources of interorganizational competitive advantage", *Academy of Management Review*, 23(4), 660-679.

Ehiraj, Sendil K.; Kale, Prashant; Krishnan, M.S.; & Jitendra, V. (2004). "Where Do Capabilities Come From and How Do They Matter: A Study of the Software Services Industry," unpublished paper.

Eisenhart, Kathleen M. & Schoonhoven, Claudia Bird. 1990. "Organizational Growth: Linking Founding Team, Strategy, Environment, and Growth among US Semiconductor Ventures, 1978-88," *Administrative Science Quarterly*, vol. 35, no. 3 (pp. 504-530)

Eriksson, Kent and Sylvie Chetty (2003). "The Effect of Experience and Absorptive Capacity on Foreign Market Knowledge", *International Business Review*, 12, 573-695.

Ernst, Dieter (2004): "Global production networks in East Asia's electronics industry and upgrading prospects in Malaysia", in Yusuf, Shahid, M. Anjum Altaf and Kaoru Nabeshima (Eds) (2004): *Global production Networking and Technological Change in East Asia*, Oxford University Press and World Bank, Washington DC. 89-157.

Forsgren, M. and J. Johanson, (1992). "Managing Internationalisation In Business Networks". In: Forsgren, M. and J. Johanson, Editors, 1992. *Managing networks in international business* Gordon and Breach Science Publishers, Amsterdam, pp. 1–16.

Giarratana, Marco; Pagano, Alessandro; & Torrisi, Salvatore. 2005. "The Role of Multinational Corporations" Arora, Ashish & Gambardella, Alfonso (eds.), *From Underdogs to Tigers: The Rise and Growth of the Software Industry in Brazil, China, India, Ireland, and Israel*. Oxford: Oxford University Press

Glejser, Herbert; Jacquemin, Alexis; and Petit, Jean. 1980. "Exports in an imperfect competition framework: an analysis of 1,446 exporters," *Quarterly Journal of Economics*, vol. 94, no. 3, pp. 507-24.

Havnes, Pers Anders; Senneseth, Knut, (2001). "A Panel Study of Firm Growth among SMEs in Networks", *Small Business Economics*; 16(4), June 2001, pages 293-302.

Hay, D.A. and D.J.Morris (1991). *Industrial Economics and Organisation: Theory and Evidence*, 2nd edition, Oxford University Press, Oxford.

Heeks, Richard B. & Nicholson, Brian. (2002). "Software Export Success Strategies in Developing and Transitional Economies," University of Manchester Institute for Policy Development and Management, Working Paper No. 12

Holm, Blankenburg D., K. Eriksson, and J. Johanson, (1996). "Business Networks And Cooperation In International Business Relationships", *Journal of International Business Studies* **27** 5, 1033–1053.

Khanna, Tarun. 2004. "India's Entrepreneurial Advantage," *McKinsey Quarterly*, 2004 Special Edition (www.mckinseyquarterly.com)

Khanna, Tarun and Palepu, Krishna G (2004), "Globalisation and convergence in corporate governance: evidence from Infosys and the Indian software industry", *Journal of International Business Studies*, 35, 484-507.

Krugman, Paul (1990). *Rethinking International Trade*. Cambridge, MA: MIT Press.

Kumar, M. S. (1984). *Growth, Acquisition and Investment: An Analysis of the Growth of Industrial Firms and their Overseas Activities*, Cambridge: Cambridge University Press.

Kumar, Nagesh and Siddharthan, N.S. (1994). "Technology, firm size, and export behaviour in developing countries: the case of Indian enterprise," *Journal of Development Studies*, vol. 31, no. 2 (December), pp. 289-309.

Lechner, Christian; Dowling, Michael; & Welpe, Isabell. 2006. "Firm networks and firm development: the role of the relational mix," *Journal of Business Venturing*, v 21 (July) pp. 514-540

Luo, Yadong. 2002. "Partnering with Foreign Business: Perspectives from Chinese Firms," *Journal of Business Research*, v. 55, pp. 481-493

Luo, Yadong & Park, Seung Ho. 2005. "Multiparty Cooperation and Performance in International Equity Joint Ventures," *Journal of International Business Studies*, v. 35, pp. 142-160

Marris, R. 1971. "Theories of Corporate Growth," in Marris, Robin & Wood, Adrian (eds.), *The Corporate Economy*. Cambridge MA: Harvard University Press

Marris, R. (1964). *The Economic Theory of Managerial Capitalism*, Macmillan, London.

NASSCOM. (2005). *The IT Industry in India: Strategic Review 2005*. New Delhi: NASSCOM.

Nollen, Stanley. 2005. "Intellectual Property in the Indian Software Industry: Past Role and Future Need," in Thatchenkery, Tojo & Stough, Roger (eds.). *Information Communication Technology and Economic Development: Learning from the Indian Experience*. Northhampton, MA: Edward Elgar Publishing

Oviatt, B. M. and P. P. McDougall (1994). "Towards a Theory of International New Ventures", *Journal of International Business Studies*, 25(1), 45-64.

Patibandla, Murali. (1995). "Firm Size and Export Behaviour: An Indian Case Study," *Journal of Development Studies*, vol. 31, no. 6, pp. 868-882.

Radhakrishnan, Nithya. (2004). "Building Successful Software Companies in Developing Countries: The Case of India and Infosys." Presented at International Intellectual Property Institute conference, Honolulu (May)

Ramamurti, Ravi & Devesh Kapur. (2001). "India's Emerging Competitive Advantage in Services," *Academy of Management Executive*, vol. 15, no. 2 (May)

Riccaboni, Massimo; Pammolli, Fabio, (2002). "On Firm Growth in Networks", *Research Policy*. December 2002; 31(8-9): 1405-16

Rowthorn, R. (1971). *International Big Business 1957-1967: A study of comparative growth*, Cambridge, Cambridge University Press.

Shanmugam,K. R; Bhaduri, Saumitra N, (2002), "Size, Age and Firm Growth in the Indian Manufacturing Sector", *Applied Economics Letters*. July 2002; 9(9): 607-13

Shepherd, W. G. (1972). "The elements of market structure", *Review of Economics and Statistics*, 54(1), 25-37.

Siddharthan, N. S. and Lall, S. (1982). The recent growth of the largest US multinationals, *Oxford Bulletin of Economics and Statistics*, vol. 44, 1-13.

Siddharthan, N. S. , Pandit B. L. and Agarwal R. N. (1994). Growth and profit behaviour of large Indian firms, *The Developing Economies*, vol. 32, no. 2, 188 - 209.

Siddharthan, N. S. and Stanley Nollen (2004a): "MNE affiliation, firm size and exports revisited: A study of information technology firms in India", *The Journal of Development Studies***,** 40 (6), 148-170.

Siddharthan, N. S. and Stanley D. Nollen (2004b), "International growth by networking but not M&A: the counter example of the Indian software industry", in Michael A. Trick (ed) *Global Corporate Evolution: Looking Inward or Looking Outward?* International Management Series, Vol. 4, Carnegie Mellon University Press, Pittsburgh (2004), 53-60.

Sridharan, E. 2004. Evolving Towards Innovation? "The Recent Evolution and Future Trajectory of the Indian Software Industry," in D'Costa, Anthony & Sridharan, E. (eds.), *India in the Global Software Industry*. Basingstoke, UK: Palgrave Macmillan

Variyam, Jayachandran N. and David S. Kraybill. (1992). "Empirical Evidence on Determinants of Firm Growth", *Economics-Letters*, 38(1), 31-36.

Walter, Achim; Auer, Michael; & Ritter, Thomas. 2006. "The impact of network capabilities and entrepreneurial orientation on university spin-off performance," *Journal of Business Venturing*, vol. 21 (July), pp. 541-567

Willmore, Larry. (1992). "Transnationals and foreign trade: Evidence from Brazil," *Journal of Development Studies*, vol. 28, no. 2 (January), pp. 314-335

Yusuf, Shahid (2004): "Competitiveness through technological advances under global production networking" in Yusuf, Shahid, M. Anjum Altaf and Kaoru Nabeshima (Eds) (2004): *Global production Networking and Technological Change in East Asia*, Oxford University Press and World Bank, Washington DC. 1-34.

Table 1
Software Sales Revenue for India, 1990-91 to 2004-05 (millions of USD)

INDIA	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
Software & Services Revenue	209	289	382	545	803	1182	1798	2929	4009	5538	8280	9965	12455	15574	22193	30300
Domestic	99	123	161	222	330	471	724	1150	1379	1537	2020	2280	2580	3374	4973	6700
Exports	110	166	221	325	473	711	1074	1707	2599	3962	6204	7653	9875	12200	17220	23600

Note: Years refer to Indian fiscal year from April 1 to March 31

Sources: NASSCOM, Dataquest

Table 2.
Values of Variables for Indian Software Firms

Variable	***Value***
Sales revenue growth (2002 vs 2001)	
Mean	31.2%
Range	-97.0% to 1639%
Standard deviation	163.0
Profit margin in 2002 (gross profit/revenue)	
Mean	16.7%
Range	-209 to 73.3%
Standard deviation	31.2
Labor productivity (mean revenue/worker)	$31,381
Managers' education (mean percent with graduate degree)	51.8%
Manager's experience (mean years of experience of top manager in this line of business)	18.2 years
Entrepreneurial orientation (mean scale score out of 15)	11.1
Quality certificates (percent with CMM certificate(s))	47%
Royalties or technology fees received (mean percent yes)	79%
New products (number introduced in the last year)	
Foreign ownership	
mean foreign equity share	23.5%
percent with some foreign ownership	57.2%
Foreign non-equity strategic alliances	
mean number	4.1
percent with foreign non-equity strategic alliances	69.8%
Non-residents' role importance for access to markets, management, technology, and capital (mean scale score out of 20)	6.2
Size of firm (median sales revenue in 2002	$6,451,000
Age of firm (mean years since founding of the firm)	12.1 years
Line of business: services firms	76%
Sample size	111 to 118

Source: IFC survey data collected for this study

Table 3
Determinants of Revenue Growth and Profit Margin for Indian Software Firms

	Revenue Growth		***Profit Margin***	
Explanatory variable	OLS	SUR	OLS	SUR
International linkages				
Foreign alliances (number of non-equity strategic alliances)	1.925** 1.010	1.900** 0.957	0.960*** 0.360	0.983*** 0.341
Foreign ownership (% of equity)	0.279 0.187	0.274 0.178	0.071 0.069	0.070 0.065
Non-residents' role (access to markets, management, technology, capital)	-1.030 0.855	-0.952 0.810	0.819*** 0.309	0.828*** 0.293
Technology				
Royalties received (firm received royalties from abroad or not)			9.796* 5.295	9.344* 4.990
New products introduced (number of new products introduced)	2.252 2.475	2.135 2.334		
Management and labor				
Labor productivity (sales revenue per worker)	0.001*** <0.000	0.0007*** 0.0003	<0.000 <0.000	2.44E-05 9.67E-05
Managers' experience (for growth, yrs experience top manager) or education (for profits, % post-graduate degree)	2.130** 0.952	2.103** 0.898	0.022 0.064	0.014 0.060
Quality certification (firm has CMM or ISO certificates or not)	27.86* 16.58	29.86** 15.72		
Controls				
Size of firm (log of sales revenue in 2001)	-66.69*** 11.30	-66.69*** 10.68	-0.252 3.213	-0.295 3.038
Capital intensity (fixed assets/employment)	<0.000 <0.000	4.59E-07 2.08E-06	<0.000 <0.000	1.09E-06 2.54E-07
Age of firm (years since began operations)			-0.739** 0.359	-0.786*** 0.338
Constant	494.2*** 83.14	495.6*** 78.6	5.928 25.692	7.956 24.30
Adjusted R2	0.259	0.257	0.125	0.125
Sample size	104	104	97	97

Revenue growth is sales revenue in 2002 minus sales revenue in 2001 divided by sales revenue in 2001
Profit margin is gross profit divided by sales revenue in 2002

OLS is ordinary least squares; SUR is seemingly unrelated regressions

Standard errors are below estimated coefficients. ***, **, * indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively for two-tailed tests

One observation (case 1422) has an extreme value for revenue growth, one observation (case 1411) has an extreme value for profit margin, and each has a large residual in its respective OLS equation; they are omitted from the results shown here

Table 4
Determinants of Growth and Profit Margins of Chinese Software Firms

	Revenue Growth		***Profit Margin***	
Explanatory variable	SUR	OLS	SUR	OLS
Constant t value	2.832 1.07	3.041 1.50	0.996 0.06	3.700 0.25
Capital intensity (fixed assets/employment)	0.087*** 2.57	0.085** 2.11	0.044 0.26	0.046 0.45
Foreign ownership (%)			-0.127*** -3.27	-0.131*** -2.61
FDI Outflow (0-1)	-8.471*** -3.88	-8.411** 2.33	-2.600 -0.23	-3.328 -0.40
% of managers with education from abroad	-0.125*** -3.31	-0.119** -2.19		
% of managers with post graduate degree			-0.111** -1.94	-0.114 -1.64
% of managers with work experience abroad	0.053 1.03	0.043 0.99		
Importance of OC role (5=very important, 1=no benefit)	0.492*** 6.14	0.496** 2.04	-0.090 -0.22	-0.030 -0.08
Number of patents	-0.901*** -3.84	-0.909** -2.16	-4.887*** -3.81	-4.801*** -2.71
Received royalties or fees from abroad (1=yes, 2=no)			6.318 0.91	4.268 0.62
R&D Cost			0.254*** 3.18	0.251*** 2.75
Entrepreneurial orientation (Scale of three questions)	0.610*** 2.73	0.585* 1.71	0.813 0.74	0.847 0.57
Quality certificates (SEI CMM) (1=have, 0=do not have)	4.291** 2.12	4.356* 1.89	23.106** 2.33	23.487** 2.01
R^2	0.5746	0.5754	0.4514	0.4529
No of included observations	37	37	40	40

Note: * significant at 10%, ** at 5% and *** at 1%

Endnotes

[i] The industries are not defined identically in each country, and therefore our comparison is approximate. The source for India is NASSCOM (2004); the figure includes IT-enabled services. The sources for China are Hu, Zhangxi, & Foster (2003) and Hu & Sheng (2004). Sources for hardware data are Ministry of Information Technology in India and China Unicom in China.