

Non-equity Alliances and the Performance of Indian Software Firms

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Abstract

The Indian software industry has grown very rapidly for more than a decade. In this study we report the results of a multivariate statistical analysis of the determinants of sales revenue growth and profit margins of Indian software firms. Based on original firm-level survey data, our SUR estimates show that both the firm's growth and profits are greater if it has more foreign non-equity alliances. Firms enjoying higher labor productivity with experienced managers and holding quality certifications achieve higher growth while firms of recent vintage having greater interaction with non-resident Indians report higher profit margins.

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The Indian software industry has grown rapidly since the early 1990s, and reached \$23.4 billion in total revenue in 2004-05. 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 2005). 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 ascent of the Indian software industry into worldwide prominence requires explanations. What enabled Indian software firms to grow so fast? How can we explain the performance of the firms in this industry? In this study we attempt to measure and analyze some of the variables that might have contributed to the growth and profitability of Indian software firms.

The Indian Software Industry

The Indian software industry began by providing customized software services to customers abroad, mainly in North America, using the "body shopping" model in which Indian software employees were located temporarily at the customer's place of business to do programming, testing, and maintenance. Over time, off-shore provision of software services performed in India supplemented or replaced on-site provision, enabled by the electronic transmission of output to the customer. Software services remains the dominant output, accounting for more than 90% of the industry's sales revenue, rather than packaged software products.

The availability of large numbers of technically well-educated Indian young people who are paid low wages (in dollar terms, compared to US wages) is frequently cited as the Indian industry's main competitive advantage, along with the ability of all educated Indians to use the English language (among several studies, see especially Ramamurti & Kapur 2001). The acknowledged deficiencies of physical infrastructure in India that adversely affect manufacturing industries are less critical to software services.

The Indian software industry is mostly home-grown. Foreign ownership of software operations in India is quite small – fewer than one-fifth of Indian software firms are majority

foreign-owned (Commander 2003), and among the 20 biggest software firms, only three are majority foreign owned.¹ Nevertheless, the presence in the U.S. of non-resident Indians is frequently mentioned as an important contributor to Indian firms' international business success (Ramamurti & Kapur 2001).

Growth and Profits

We explain the performance of firms in the Indian software industry with two different but related measures: growth and profits. Growth refers to change in sales revenue, and profits refer to profit margin, which is gross profit relative to sales revenue, or return on sales.² We utilize both growth and profits in the analysis of software firms because both are especially important for firms in high technology industries, and therefore we can give a broader picture of the firm's performance. Managers of these firms seek growth along with satisfactory profits. In the managerial models of the firm (Hay and Morris 1991; Marris 1964), the relationship between growth and profits can in principle be either negative or positive. These models postulate an inverted 'U' shaped growth-profit frontier where up to a point growth and profits have a positive relationship and beyond that point the relationship turns negative. Nevertheless, the firm could achieve both higher growth and profits by shifting out the growth-profit frontier.

To achieve both faster growth and higher profits, the firm must diversify into new products or new markets. To do so requires innovation and marketing, and it requires managerial capabilities. For international growth, it also requires linkages abroad. 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

¹ This is not meant to minimize the catalytic but largely circumstantial role that foreign firms played in the development of the Indian software industry. IBM's departure from India in 1974 stimulated domestic software development by Tata Consultancy Services (still the biggest software firm in India), and Texas Instruments' investment in Bangalore in 19xx stimulated the growth of software suppliers to it.

² 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.

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.

Framework to Explain Growth and Profits for the Firm

We explain the growth in sales revenue and the profit margin of the firm in two separate equations, each in terms of the capacities of the firm's management and labor, its technology activities, and its international linkages, with control variables. To allow for the potential relationship, either positive or negative, between growth and profits, we experiment with including the firm's profit margin as an endogenous right-hand side variable in the growth equation, and by 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.

Management and Labor

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. Previous studies suggest that the skill and abilities of Indian software managers and professionals are important to explain the growth, profits, and export performance of Indian software firms. For example, Ehiraj et.al. (2004) show a quantitative relationship between project management capabilities and profits, and Tschang (2003) suggests that Indian software managers are more capable than Chinese managers.

Hypothesis 1a. We expect firms with more educated and more experienced managers to be faster growing and more profitable than firms whose managers are less educated and experienced.

Software services production is skilled labor intensive – labor accounts for about 70% of total costs (Khanna & Palepu 2004) – and therefore labor productivity should be important to a software services firm's performance. Firms with greater labor productivity have been shown to be more export intensive than firms with lesser labor 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 1b. We expect firms with higher labor productivity to be faster growing and more profitable than firms with lower labor 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.

Hypothesis 1c. 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 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. 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 1d. 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 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 2. 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.

International Linkages

International linkages are evidently important to the growth of firms in an export-oriented industry. One form of international linkage for firms is non-equity strategic alliances and networking with firms abroad. The argument is that firms learn about foreign markets through collaborations with other firms. Several recent empirical studies show that alliances, networking, and collaborative agreements contribute to the performance and competitive success of a firm (Dyer & Nobeoka 2000; Forsgren & Johanson 1992; Holm, Eriksson, & Johanson 1997; Riccaboni & Pammolli 2002)), and in particular to growth via the geographic extension of markets (Havnes & Senneseth 2001). Oviatt & McDougall (1994) show that internationalization for software firms depends on networking.

In fact alliances and networking are often used in the software industry. They potentially enable international growth for firms via any of four mechanisms. Alliances facilitate exporting because they do not require that the partners be large firms, they might 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 customer industry abroad. In the Indian software industry, many firms have large numbers of alliances, often for technology or market access reasons (Siddharthan & Nollen 2004b).

Hypothesis 3a. 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 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 multinationality and growth in cross-sectional samples of firms or industries. In any event, foreign ownership is quite small among Indian software firms.

Hypothesis 3b. We do not expect foreign ownership to be a significant contributor to the growth or profitability of Indian software firms.

A third form of international linkage is the role played by non-resident Indians (NRIs). 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). Their role in promoting exports by opening access to foreign markets has been emphasized (Heeks & Nicholson 2002).

Hypothesis 3c. We expect that firms that report greater benefits from the role played by non-resident Indians will have faster growth and greater profitability than firms that report fewer benefits.

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 2004).

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 background 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 profits.

Line of Business. To the extent the 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 used in the empirical analysis come from original survey research conducted by the Confederation of Indian Industry (CII) for the International Finance Corporation. The sample size 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.³ 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.

Dependent Variables

- Sales revenue growth during the period 2001-2002
- Profit margins of firms in 2002 (gross profits/sales)

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

- Labor productivity – output/employment, \$/worker
- Managers' education – percent with post graduate degree
- Manager's experience – years of experience of top manager
- 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 SEI certificate(s) and 0 if not
- Royalties or technology fees received from abroad – binary variable with value = 2 if the company received royalties or technology fees 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

³ 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 composed 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)
- Firm size – sales revenue in 2001
- Age of the firm in number of years
- 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 these 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

The rate of growth of sales revenue in the measured one year period is highly 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.

Determinants of Growth

Indian software firms with faster revenue growth are firms that have higher labor productivity, managers with more experience, and CMM quality certifications (Table 3, columns 1 and 2).⁴ All of these variables reflect labor and management capabilities. 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 Indian software firms. 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 have not emerged 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' profitability are international linkages, in two ways. Firms with more non-equity alliances with foreign firms have larger profit margins than firms with fewer alliances, as was also true for the explanation of revenue growth. In addition, firms whose top manager reports 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 done better than older firms. As reported in the firm profiles of the *Capital Line* data set, most of the older firms were started by traditional business families and a good number of the newer ones have been launched by persons with engineering or technical backgrounds.

The labor and management variables – labor productivity and managers' education – did not come through the multivariate analysis with significant effects on profit margins, unlike the

⁴ The result for labor productivity occurs when the capital-labor ratio is also entered as a control variable, and it also occurs when the software services versus products line of business of the firm is included (the latter result is not shown).

case for revenue growth. Foreign ownership, with a positive sign, was not significant, nor was firm size, unlike the result for revenue growth.

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 software industry, using new survey research data collected for this purpose.

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. The alliances were typically either marketing or technology alliances, which can contribute both to growth and profits. 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.

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 the internet technology and intellectual property protection offered by the WTO framework, and established knowledge sharing relationship with Indian firms for mutual benefit.

The content of the alliances, and the roles that the Indian and foreign alliance partners play, are similar across the alliances. 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 some cases, technology alliances have no immediate third-party customer, and instead the Indian and foreign software companies jointly create new software products (Siddharthan & Nollen 2004b).

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).

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.

Growth and Profits: Differences

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 labor and management: labor 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 compared, for example, to Chinese 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 labor variables – labor productivity, manager's experience, and quality certifications – affect growth but not profits, while technology – royalties and technology fees received – affects profits but not growth.

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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
Software & Services Revenue	209	289	382	545	803	1182	1798	2929	4009	5538	8280	9965	12455	15574	22193
Domestic	99	123	161	222	330	471	724	1150	1379	1537	2020	2280	2580	3374	4973
Exports	110	166	221	325	473	711	1074	1707	2599	3962	6204	7653	9875	12200	17220

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

<i>Variable</i>	<i>Value</i>
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 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 (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: Survey data collected for this study

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

<i>Explanatory variable</i>	<i>Revenue Growth</i>		<i>Profit Margin</i>	
	OLS	SUR	OLS	SUR
<i>Management and labor</i>				
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 (growth) (yrs experience top manager) or education (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		
<i>Technology</i>				
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		
<i>International linkages</i>				
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
<i>Controls</i>				
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