Product Market Competition and Productivity in Indian Manufacturing Industry

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Abstract

The effects of product market competition and corporate governance on the levels and the growth rates of productivity of firms in Indian manufacturing sector are examined for the decade since the economic reform in 1991. This study refines indices that capture the extent of market competition. Empirical results indicate that the smaller the market share of a firm, the higher is the productivity growth of the firm. In contrast, the Herfindahl index does not have any significant effect. As regards the corporate governance factor, debt asset ratio is not found to have any significant effect on productivity or growth rate in productivity, indicating insufficient disciplinary powers by banking sectors.

JEL Classification No.: L25, L53

Key words: Product Market Competition, Productivity Level, Productivity Growth
1. Introduction

This study investigates the effects of product market competition and corporate governance on both the level and the growth of firm productivity in the Indian manufacturing sector for the decade from 1991-1992 to 2001-2002. An attempt is made in this study to construct more elaborate measures that capture the extent of product market competition.

The Government of India embarked on drastic economic reform in 1991 after a phase of gradual deregulations during the 1980s. The drastic economic reform included deregulations in industry, as well as changes in trade regime, while financial reform was relatively slow through the 1990s. Some scholars examined the effect of the economic reform and found that there was a decline in the growth rate of productivity in many industries (for example, Srivastava, 2000; Balakrishnan, Pushpangadan and Basu, 2000; Goldar, 2004). However, their approaches determine whether productivity increased or decreased during the 1990s. Thus, it is not evident what measures among the comprehensive reform package affect productivity. Therefore, more detailed analysis is called for in the evaluation of the economic reform.

In the empirical studies of the effect of market competition, various indices including n-firm concentration ratio, Herfindahl index, above normal rent, or questionnaire based results have been used to proxy for the extent of market competition. In the Indian context, Goldar (1986a, b) applied concentration ratio to analyze its effect on productivity, but he did not find statistically significant effects. However, in studies for other countries, positive effects of product market competition on productivity have been reported. For instance, based on the data of British firms, Nickell (1996), Nickell, Wadhwami and Wall (1992), and Nickell, Nicolitsas and Dryden (1997) show that different kinds of indices of product market competition enhance productivity growth.

However, there is a reasonable doubt among scholars that any kind of index at an aggregate level does not precisely capture competitive pressure faced by a firm in product markets. This is because, first, at an aggregate industry level, many different products are included, which are not necessarily substitutes; second, each firm usually produces a variety of products, which do not necessarily fall into the same industrial classification.
In this paper we attempt to construct a more elaborate index of the competitive pressures faced by a firm. We begin with the competition variables (Herfindahl index, import ratio, market share) at each product market level, where products produced by each firm can be regarded as substitutes. Then we aggregate them for a respective firm. In this study, without any prior knowledge of any specific functional form, we simply calculate a weighted sum of market level competition variables, using as weights the percentage of the sales of each product in the total sales of the firm. We use these aggregate competition variables, as well as above normal rent, to see the effect of competition on productivity.

In addition, we also attempt to see the effect of corporate governance factors on productivity. Unfortunately, for the period of this study the available data on shareholding patterns are incomplete. Thus, we just test the effects of the threat of bankruptcy (proxied by debt asset ratio).

In this study we examine the effects of these explanatory variables on both the level and growth of productivity. Previous studies usually a priori choose one of them as performance criterion. The level of productivity is partly a result of the past accumulation (or deterioration) of productivity growth. Whether a certain set of variables affect either the level or growth of productivity depends on the speed of the realization and persistence of their effects. Thus in this study we try both measures.

Our main estimation results show that the smaller the market share of a firm is, the higher the productivity growth of the firm becomes. Moreover, this effect is more prominent in a less concentrated market. In contrast, Herfindahl index does not have any significant effect on either the level or the growth rate of productivity. As regards corporate governance factor, debt asset ratio does not bear a significant relationship with productivity.

The results indicate that a policy measure that deprives large firms of market power may be conducive to productivity growth. In such a situation where a firm can occupy a small market share confronted by many rival firms, it may face more competitive pressure and the firm's manager would make greater efforts to enhance the productivity. In contrast, the threat of bankruptcy as reflected by debt asset ratio does not seem to have any positive effects on productivity enhancement. This seems to be partly explained by the fact that in India a great deal of long-term finance is provided by
government controlled banks, which have little incentive to monitor borrowing firms. From these results, further deregulation of financial sector should be considered in order to give financial institutions incentives to monitor borrowing firms.

The rest of the paper is organized as follows. Section 2 gives an overview of theoretical and empirical background of this study. Section 3 discusses these issues in the Indian context. Estimation models are introduced in Section 4, and the construction of variables and data are explained in Section 5. Section 6 presents our estimation results. Section 7 concludes the paper with some policy implications based on these results.

2. The Background

In this study we presume that managers' efforts play a vital role in the improvement of firm productivity. Then we examine whether product market competition and corporate governance influence the level or the growth rate of productivity, presumably through managers' efforts. In this section we give a brief overview of theoretical and empirical backgrounds of this study.

2-1. Competition

Casual argument broadly asserts that competition, both domestic and international, may enhance the productivity of firms or industries by motivating the efforts of corporate managers.

However, the theoretical literature on the effect of market competition does not clearly accord with this casual argument. One of the reasons for this is that there are various definitions of competition in the theoretical literature. Intensification of market competition is captured by, for instance: the change in the mode of competition, from monopoly to perfect competition (for example, Arrow, 1962) and from cartel to Cournot to Bertrand competition (for example, Horn, Lang and Lundgren, 1994); increase in the number of firms (for example, Loury, 1979; Lee and Wilde, 1980; Dasgupta and Stiglitz, 1980a,b; Reinganum, 1982, 1985; Spence, 1984; Martin, 1993; Krishna, 2001); the number of other managers to whom each manager is compared (for example, Holmstrom, 1982; Nalebuff and Stiglitz, 1983; Mookerjee, 1984; Hermelin, 1992); increase in the price elasticity of demand (for example, Willig, 1987); reduction of the size of demand (for example, Willig, 1987; Hermelin, 1992); decrease in profits (for
example, Schmidt, 1997); increase in the substitutability between products (for example, Aghion, Dewatripont and Rey, 1997); reduction in the gap between a leader and a follower (for example, Harris and Vickers, 1987); forward movement towards goal by one of rivals (for example, Harris and Vickers, 1987); the increase in the ratio of entrepreneurial firms relative to managerial firms (for example, Hart, 1983; Scharfstein, 1988); existence of a potential rival (for example, Gilbert and Newberry, 1982; Nalebuff and Stiglitz, 1983). Many of these theoretical models are based on principal agent model, in which the owners of a firm design incentive scheme for the manager, but the structure of the scheme depends on various factors including market competition. The models analyze how the optimal incentive scheme changes in response to the change in the extent of market competition.

The definitions of competition are so diverse and, furthermore, the results rely on factors incorporated into these models. Not surprisingly, it is not theoretically evident whether the intensification of market competition would induce managers to exert more efforts.

In spite of the ambiguity of theoretical predictions, empirical studies have tried to test the hypothesis that market competition would increase the efforts of managers, and thus lead to higher performance, including higher productivity. Empirically, the extent of competition has been captured by several variables; concentration ratio, above normal rent, market share and questionnaire based results. A connection between concentration and productivity is based on the presumption that as the market gets concentrated, it is more likely that the firms in the industry would collude, and less rigorously, that in a more fragmented market with a larger number of firms competition should be intense. Thus, a higher concentration is expected to be associated with lower productivity. The manager of a firm registering high above normal rent may feel less competitive pressure and thus make less effort, leading to lower productivity. If a firm has a small market share, it may reflect the fact that the firm is at a disadvantageous position relative to other firms with larger market shares. Thus, the manager of a firm with a smaller market share may feel more competitive pressures, and make more efforts to raise productivity.

With regard to the effect of market competition on productivity, several rigorous empirical studies have been done. Nickell (1996) shows that the increase in the number of rival firms or the decrease in rents enhanced the productivity growth of British firms.
Nickell, Wadhwani and Wall (1992) show that the increase in market share of a firm reduces its productivity growth. Nickell, Nicolitsas and Dryden (1997) obtained the result that higher average rents normalized on value added tend to reduce productivity growth. Green and Mayes (1991) claim that the extent of competition is among the important variables that significantly explain the difference in efficiency.

Other scholars claim that deregulation, which is expected to intensify competition, raises productivity of firms. For example, Olley and Pakes (1996) show that in telecommunications equipment industry in the US, productivity growth accelerated after the deregulation of the industry. Similarly, the positive impact of deregulation in transition economies was reported by Li (1997) for China, by Djankov and Hoekman (2000) for Bulgaria, and by Grosfeld and Tressel (2002) for Poland. As will be mentioned in the next section, the effects of the Indian economic deregulation since 1991 have also been explored extensively.

Another important channel through which competition is conducive to productivity improvement is the turnover of firms in industries. Competition forces firms with low productivity to exit, while firms with high productivity remain in the market. Or the latter may expand its market shares, whereas the former may lose its market shares. The effect of this turnover has been examined by, among others, Dunne, Roberts and Samuelson (1988), Baily, Hulten and Cambell (1992), Baldwin (1995), Baily and Gersbach (1995), Bartesman and Doms (2000), Aw, Chen and Roberts (2001). All of them indicate that the turnover plays a critical role in the increase in the productivity of industries. In this paper we do not examine this turnover effect, but we focus on the effect of product market competition promoted by the deregulations in India in the 1990s.

This paper makes improvements on the existing literature in two respects. First, we make more refined measures of product market competition. In most of the studies, the index of product market competition is calculated at a rather aggregated level. However, at those levels, products produced by sample firms are not necessarily substitutes in the sense that the decrease in the price of a firm's product reduces the demand faced by other firms. In this study, we start with the data at product levels, compiled by the Center for Monitoring Indian Economy (CMIE). CMIE selects hundreds of main products and gathers data on those product markets, which is compiled in Industry: Market Sale and Shares. This data book includes the data on each firm's sales and
market share in each product market, as well as the Herfindahl index of the market among domestic firms and import ratio in the total domestic market sales.

Each firm produces a variety of products and sells them in different markets. When a manager makes an important strategic decision or makes efforts with regard to each product, the manager puts different weights on each product, depending on the importance of each product. For instance, a manager may probably exert more efforts towards a product which account for 80 per cent of the firm's sales than towards the one with only 1 per cent. In this study we simply assume that the manager puts more weight on the product that accounts for higher percentages of sales in the firm's total sales. Accordingly, for each firm we construct a weighted sum of competition related indices in each product market, namely, import ratios, Herfindahl indices, and market shares. Furthermore, we also make another competitive pressure variable, above normal rent, that may capture overall competitive pressure, faced by a firm.

Second, we do not a priori determine the choice of the level or the growth of productivity as performance criterion. The existing studies vary in the choice of dependent variables. Some use the level of productivity and others use the growth rate of productivity. In this study we regress both on the same set of explanatory variables, to see which is more affected by those explanatory variables.

2-2. Corporate Governance
A properly designed structure of corporate governance is generally expected to enhance the productivity of firms because it disciplines corporate managers, who might otherwise seek private benefits rather than firms' or shareholders' benefits.

In studies on corporate governance, the dependent variables considered in regression analysis include Tobin's q, share price, return on equity (ROE) and return on assets (ROA), rather than productivity, because of their focus on the returns to shareholders. With respect to those performance variables, the independent variables that have been tested include: debt/asset ratio or interest payment over net cash flow as the risk of default (for example, McConnell and Servaes, 1990; Nickell, Wadhwami and Wall, 1992; Ofek 1993), the pattern of shareholdings (for example, Morck, Shleifer and Vishny, 1988; McConnell and Servaes, 1990; Ofek, 1993; Mehran, 1995; Denis, Denis and Sarin, 1997) and the identity of ownership such as directors, government, financial institutions, foreigners and so forth (for example, Lichtenberg and Pushner, 1994;
Kaplan and Minton, 1994; Kang and Shivdasani, 1995; Nickell, Nicolitsas and Dryden, 1997), board structures (for example, Yermack, 1996; Core, Holthausen and Larcker, 1999), and the threat of takeovers (for example, Lichtenberg and Siegel, 1990; Mitchell and Lehn, 1990; Martin and McConnell, 1991; Berger and Ofek, 1996).

Among these studies, the followings focus on the effect of corporate governance variables on productivity. Nickell, Nicolitsas and Dryden (1997) obtain the result that, if financial institutions are large shareholders, then a firm's productivity growth would be higher in the UK. Similarly, Lichtenberg and Pushner (1994), based on Japanese firm data, demonstrate that financial intermediaries as large shareholders exert a positive impact, but cross-shareholdings have a negative impact, on productivity of firms. Nickell, Wadhawami and Wall (1992) show that firms with a higher debt tend to have a higher growth rate of productivity.

Among the variables examined in the previous studies, we focus on the risk of default captured by the debt/asset ratio in this study. One of the reasons for this choice is the non availability of time series data of shareholding patterns during our sample period. Another reason for the choice of the debt/asset ratio is that in India debt finance, especially long-term debt, is obtained mainly from government development financial institutions (for example, IFCI, IDBI, ICICI, IIBI). Some argue that the personnel of government-controlled financial institutions are not well motivated to monitor the companies that they finance (for example, Banerjee, Cole and Duflo 2003). Therefore, our conjecture is that in India the debt/asset ratio does not affect either the level or the growth of productivity of firms.

With respect to the effect of the debt/asset ratio, Jensen (1986) theoretically claims that if there is abundant cash flow, a manager may seek private benefits. Conversely, if a firm's debt is high, that is, the risk of default is high, and then a manager cannot use the free cash flow for private benefits. On the other hand, signaling theory (for example, Ross, 1977) argues that a manager signals his/her competence by obtaining funds through debt finance.

Empirically, the disciplinary role of debt with respect to these dependent variables is reported by McConnel and Servaes (1990, 1995). Ofek (1993) also shows that executives are more likely to take actions conducive to good performance as debt/asset ratio increases. And as already mentioned, Nickell, Wadhawami and Wall (1992) show that
firms with higher debt tend to have a higher growth rate of productivity.

3. The Indian Context

There is a large literature regarding the productivity of firms or industries in India. Among them, the determinants of productivity are investigated in many studies. The issue that attracts most attention is the effect of the economic deregulations since 1991.

The deregulations in industry include the followings. First, a large part of licensing requirements were abolished except for several industries. Second, the industries preserved for public sector were reduced. Third, prior scrutiny, by government, of investment by MRTP companies is no longer required. Fourth, ceilings on foreign direct investment in domestic firms in some industries were relaxed. These measures of deregulation are supposed to promote the entry of new domestic and foreign firms, and encourage various firm activities, leading to higher product market competition.

Srivastava (2000), using firm level data, shows that there is a strong evidence of a decline in productivity growth rates in the 1990s. He also shows that the extent of productivity growth varies from state to state, and from industry to industry. This indicates that the effects of deregulation depend on various conditions. Balakrishna, Pushpangadan and Basu (2000) show some evidence of a decline in the growth rate of total factor productivity after 1991-1992. Das (2003) also confirms that many three digit industries record lower productivity growth rates in the 1990s compared to the 1980s. Conversely, Unel (2003) and TATA Services Limited (2003) claim that productivity growth accelerated after the economic deregulation in 1991. However, Goldar (2004) has pointed out the shortcomings in their methodologies and, after correcting the faults, obtained the result that there was a slowdown in productivity growth rates after 1991.

Among individual deregulation measures undertaken since 1991, the effect of liberalization of trade policy has been most intensively tested. Even before the deregulation, Goldar (1986a, b) shows that as the extent of import substitution is higher, the productivity growth is lower. Krishna and Mitra (1998) investigate the impact of trade liberalization since 1991 and find its positive effect on productivity growth. Chand and Sen (2002) obtain the result that higher effective rates of protection lowers the productivity growth. Topalova (2004) shows that the reductions in trade protection lead...
to higher level and growth of firm productivity. Das (2003) claims that the easing of import restrictions on capital goods caused a higher productivity growth of the sector, relative to intermediate and consumer goods sectors. On the other hand, Balakrishnan, Pushpangadan and Basu (2000), whose paper is already mentioned above, show an evidence of a decline in the productivity growth in the industries with significant tariff reduction after 1991-1992.

The determinants of the productivity other than the economic deregulations, which have been examined in the Indian context, include the followings: agglomeration economies (Mitra, 1999, 2000), infrastructure (Mitra, Varoudakis and Veganzones, 2002), research and development, technology imports and its spillover (Ferrantino, 1992; Goldar, 1995; Raut, 1995; Basant and Fikkert, 1996; Katrak, 1997; Fikkert and Hasan, 1998; Kathuria, 2000, 2001; Hasan, 2002; Ray, 2004) and firm size (Patibandla 1998).

However, as regards market competition there is little research in terms of its effects on productivity, except for Goldar (1986a,b). Although behind the deregulations since 1991 was the government's intention to promote the growth of firms and industries through competition, it has not been rigorously tested whether market competition contributed to productivity. This article attempts to partially fill this gap.

As regards corporate governance, many studies recently focused on it in the Indian context. Among the variables related to corporate governance, foreign ownership has attracted much attention in India. This may be because the economic deregulations since 1991 liberalized the participation by foreign companies and investors in Indian companies and their presence drastically increased in the 1990s. For instance, Goldar, Renganathan and Banga (2004) show that, in the 1990s, in Indian engineering industry foreign firms have higher technical efficiency than domestically owned firms. They also show that domestically owned firms are catching up with foreign firms due to better access to imported input and positive spillover from foreign owned firms to domestically owned firms. Banga (2004) shows that Japanese foreign direct investment has a positive effect on the TFP growth rate, while US foreign direct investments do not.

Other studies choose different performance criteria as dependent variables. Chhibber and Majumdar (1999) emphasize that foreign ownership has a significant impact on a firm's return on sales and return on assets, only when foreign owners have a significant
amount of property rights (in their formulation more than 51% of control). Ramaswamy and Li (2001) show that if foreign ownership is significant in terms of volume of ownership and board representation, then managers are less likely to pursue unrelated diversification. Sarkar and Sarkar (2000) also obtain the result that foreign equity has a positive effect on company values.

Besides foreign ownership, Sarkar and Sarkar (2000) also show that beyond a certain level, directors’ shareholdings enhance company values (market to book value ratios), while institutional investors do not. Lending institutions exert effective monitoring if they possess a substantial amount of equity in the companies that they finance. De (2003) investigates the structure and extent of interlocking directorates within large business groups in India. He shows that interlocking directorates are more prevalent in larger and less heterogeneous firms, and that directorial interlocks improve return on assets.

In spite of these many studies relating to the effect of corporate governance factors in India, the effect of debt/asset ratio on productivity has not been examined. Considering the fact that banks are the main providers of finance to firms in India, it is an important and interesting question whether they play a disciplinary role in corporate governance. Moreover, as mentioned before, in the literature of corporate governance, studies focus on indices other than productivity. Because of the importance of productivity increase for the level of national well-being, we have to examine whether corporate governance factors not only positively affect financial indices which is important to investors, but also productivity of firms.

4. Empirical Formulation

In this study we regress the level and the growth of output (value added) on the same set of level independent variables including market competition variables and corporate governance variables, controlling for primary inputs (labor and capital). As will be explained shortly, the coefficients of the independent variables can be interpreted as their effects on the level and the growth of productivity.

A level of productivity is partly a result of the past accumulation of growth (or decline) of productivity. Whether a certain set of variables influences level or growth of
productivity is a matter of the speed of the realization of its effects and also their persistence. If an effect is quickly realized and persistent, then a level of productivity at a point in time reflects the effect that was realized in the past. For instance, the finding of a new source of raw material due to a manager’s efforts in one period may quickly increase productivity in that period and its effects persist for a long time. However, if an effect is gradually realized and is not persistent, it would be difficult to capture the effect on the level. For instance, the adoption of a new way of production may take a long time before it reaches its maximum efficiency, and its effect may deteriorate through time as technological progress occurs in the economy. Thus, it is not easy to capture the effects on productivity of the factors that induce managers’ efforts. Rather than a priori choosing a dependent variable, we will see whether independent variables affect the level or the growth rate of productivity. More precise formulations are explained below.

Model 1.
Assuming a Cobb-Douglas production function, \( Y = AF(K, L) = AK^\alpha L^\beta \), and taking natural logarithm of both sides, we obtain,

\[
\ln Y_{it} = \ln A_{it} + \alpha \ln K_{it} + \beta \ln L_{it},
\]

where \( i \) is the firm subscript and \( t \) is the time subscript. \( Y_{it} \) is output, \( K_{it} \) is capital, \( L_{it} \) is labor. \( A_{it} \) indicates total factor productivity (TFP) of firm \( i \) in period \( t \). It is assumed that \( \ln A_{it} = \gamma + \delta X_{it} + \epsilon_{it} \); that is, the level of TFP is assumed to be a function of \( X_{it} \) variables. Inserting this yields,

\[
\ln Y_{it} = \gamma + \delta X_{it} + \alpha \ln K_{it} + \beta \ln L_{it} + \epsilon_{it},
\]

\( X_{it} \) is a vector of variables that may possibly affect the TFP level of a firm, and \( \epsilon_{it} \) is a random disturbance term, capturing all other shocks. Firm dummy, \( \theta_i \), and time dummy, \( \theta_t \), are also included. Thus we estimate,

\[
\ln Y_{it} = \gamma + \theta_i + \theta_t + \delta X_{it} + \alpha \ln K_{it} + \beta \ln L_{it} + \epsilon_{it},
\]

Although we do not directly regress the level of productivity on independent variables, by this formulation we can interpret the coefficients of \( X_{it} \) as their effects on the productivity. A possible problem of correlation between primary inputs and disturbance...
term is partially mitigated by including firm dummies that account for individual firm effect, and a set of variables that may affect productivity.

**Model 2.**
Assuming again a Cobb-Douglass function, \( Y = AF(K, L) = AK^\alpha L^\beta \), and taking natural logs and the derivatives with respect to time, we obtain:

\[
\hat{Y}_{it} = \hat{A}_{it} + \alpha \hat{K}_{it} + \beta \hat{L}_{it},
\]

where \( \hat{\cdot} \) indicates the growth rate of each variable. In Model 2 it is assumed that \( \hat{A}_{it} = \gamma + \delta X_{it} + \varepsilon_{it} \); that is, the growth rate of TFP is assumed to be a function of \( X_{it} \) variables. Inserting this yields,

\[
\hat{Y}_{it} = \gamma + \delta X_{it} + \alpha \hat{K}_{it} + \beta \hat{L}_{it} + \varepsilon_{it},
\]

\( X_{it} \) is a vector of variables that may possibly affect the TFP growth rate of firm \( i \) in period \( t \) and is the same set of variables in Model 1 except for a slight difference in time period. Again firm dummy, \( \theta_i \), and time dummy, \( \theta_t \), are included. Thus, our final formulation is;

\[
\hat{Y}_{it} = \gamma + \theta_i + \theta_t + \delta X_{it} + \alpha \hat{K}_{it} + \beta \hat{L}_{it} + \varepsilon_{it}.
\]

Notice again that we examine the effects of a set of level variables on both level and growth of productivity. The same excuses apply as in Model 1 with respect to correlation between primary inputs and disturbance terms.

5. Data and variable construction

In this article I focus on the firms operating in the following eight industries: chemicals, plastics and rubber, non-metallic mineral products, base metals, non-electrical machinery, electrical machinery, electronics, and transport equipment. This choice
depends on unverified presumption that these industries are comparatively more
technology intensive, than other industries in manufacturing. Thus, the productivity is
expected to be more sensitive to managers’ efforts in response to the change in
competition variables and corporate governance variables.

deregulations of industries began in 1991, this decade should be appropriate to analyze
the effect of market competition caused by the deregulations since 1991. The primary
source of data is PROWESS, compiled by Center for Monitoring Indian Economy (CMIE).
Financial data is obtained from this data source. Other data sources are mentioned
below.

*Competition variables*

The variables that capture the extent of market competition (henceforth referred to as
competition variables, or CV) are obtained from *Industry: Market Size and Shares*,
published annually by CMIE. This data source includes the data, for each main product,
on (1) the Herfindahl index (referred to as HH), (2) the import ratio of the product
market (IMP), and (3) market share of each firm (MS). The values of HH and IMP are
common to all the firms in the same product market, while MS is specific to a firm.
CMIE calculates the Herfindahl index in *Industry: Market Size and Shares*, based only
on the domestic market sales of domestically operating firms. Namely, import is
excluded in the calculation of HH.

Each firm sells a variety of products, and the shares of each product’s sales in the firm’s
total sales vary. In addition, each product is exposed to different degrees of product
market competition. It is not obvious how managers allocate their efforts towards
various products, as well as how responsive they are to the change in product market
competition. Managers of firms do not necessarily put an equal weight on each product.
For an initial trial, it is reasonable to suppose that the more a product’s sales is, the
more efforts towards the product a manager exerts. Accordingly, in order to calculate
aggregate variables that indicate the extent of competition faced by a firm, we simply
calculate a weighted sum of competition variables, using the percentage of each
product’s sales in the firm’s total sales as weights. Note that these aggregated
competition variables are firm specific because not only each firm produces a different
set of products, but also the share of each product in a firm’s gross sales varies from firm
to firm.

A weighted sum of a competition variable of firm i (WSCVi) is:

\[ WSCV_i = \sum_{j=1}^{n} s_{ij} \times CV_{ij} \]

where \( CV_{ij} = IMP_j, HH_j, MS_j \), where \( j \) is the index of a product that firm i produces, \( s_{ij} \) is the product j’s sales share in firm i’s total sales and \( n_i \) is the index of a product firm i produces. Note that IMP and HH are product market specific variables. Thus they are identical across firms in each product market. A problem is that CMIE’s Industry: Market Size and Shares does not cover all the products existing in the economy. Therefore, I make the following normalization on WSCVi, to obtain an aggregate index of competition variables (ACVi).

\[ ACV_i = \frac{1}{\sum_j s_{ij}} WSCV_i \]

\( \sum_j s_{ij} \) is the sum of the sales of products in firm i’s total sales, covered in our data set.

In the followings we simply omit “A” in front of CVs. We only consider the observations that have \( \sum_j s_{ij} \) more than 90 per cent, so that aggregate competition variables do not deviate from actual competitive pressure so much.

In the following regression we test the interactive effect of different competition variables. Interactive terms among CVs are calculated in each product market, and then aggregated in the same manner as respective competition variables.

In addition to these aggregate competition variables, RENT is constructed by earnings before taxes and interest payments, plus depreciation, minus cost of capital times the sum of total equity and total borrowings, normalized on total assets. User cost of capital is proxied by the lending rate of interest \( ^9 \) deflated for inflation plus a constant depreciation rate (7.1%). \( ^{10} \) RENT is expected to capture above normal profit which should reflect the overall extent of competition faced by a firm.
In order to mitigate the simultaneity problem, we use competition variables in the previous period in the regression of Model 1. In Model 2 we use competition variables in the current period to see its effects on the TFP growth rate from this period to the next period.

**Corporate governance variables.**
To see the effect of financial market discipline on managers, in this study we focus on debt asset ratio (DA). DA is calculated by dividing total borrowings by total asset. The debt asset ratio is expected to capture the extent of threat of bankruptcy. When DA is high, corporate managers not only make a greater effort but also refrain from diverting cash flow towards unproductive projects. However, there is another theory that predicts a positive correlation between DA and productivity. The signaling theory implies that a manager uses debt finance if the manager is confident of future profits. We also test the same effect by interest payment over cash flow, as well as debt equity ratio. They are expected to have a positive coefficient sign. On the other hand, high DA may constrain a firm from further borrowing, which may hamper possible productive investment. If this effect is dominant, then the coefficient of DA can be negative.

As with competition variables DA in the previous period is used in Model 1, while in Model 2 DA in the current period is used.

**Control variables**
To control for other possible effects, firm size (logarithms of total assets) and age of a firm are included. Firm size may affect productivity through various channels including (dis)economies of scale or scope, and bureaucratic inefficiency. The age of a firm may possibly capture learning curve effects or exhaustion of new methods of improving productivity.

As mentioned above, year dummys are included to control for common shocks to all firms in a specific year. Firm dummys are included so that other firm specific effects not captured by the above variables would be controlled.

Note that industry dummys are not included because firms in the data set may operate in various industries. One of the main features of this study is its construction of an aggregate measure of competitive pressure for each firm when it operates in multiple markets.
Primary inputs and output

Output
We constructed deflated gross value added as a measure of output. The deflators are calculated, just as we did to obtain competition variables. Namely, the deflator applied to value added of firm i is:

\[ DEF_i = \sum_{k=1}^{n} s_{ik} \times DEF_k, \]

where \( k \) indicates a two digit level industry in which firm i operates and \( s_{ik} \) is the percentage share of sales in industry \( k \) in firm i's total sales and \( n_k \) is the index of industries in which firm i operates. \( DEF_k \) is the wholesale price index of industry k.

Labor
PROWESS contains the data on wages and salaries. I divide this number by average wage of each firm. First, the average wage of each industry is obtained by dividing the total emoluments of the industry by total mandays employed in the industry, the data of which are available from Annual Surveys of Industries. Since I do not have data on how many workers are employed for each product, the average wage of firm i is calculated as weighted average of each industry's average wage, with weights being the percentage sales in each industry in firm i's total sales.\(^{13}\)

Capital
To a large extent the study followed the method used by Srivastava (2000), which is explained in Appendix. The main differences between Srivastava's method and that used in this study are as follows. First, although Srivastava (2000) uses a balanced data set, we use an unbalanced data set, in which companies differ in the initial year. We calculate the estimated real capital stock in the initial year of each firm in our data set, using the method Srivastava took to obtain the capital stock for the base year in his study. Second, although Srivastava (2000) divided the capital into plant and machinery, buildings and other capital, we did not divide it at this stage.

6. Results
6-1. Time Trends of Variables

Table 1 shows the simple correlations among variables. Since we have an unbalanced panel data set and the software selects a set of observations for each regression, which have the data for both dependent and independent variables, the set of observations differ across regressions. Thus, the correlation coefficients in Table 1 may be slightly different from the correlations that could have been obtained from the set of observations for each regression.

Among independent variables there does not seem to be any serious problem of multicolinearity, except for that between HH and MS, which is 0.5504. Accordingly, these variables are separately regressed on. In Table 1 we include price-cost margin (PCM) to see its correlation with GVA, because competition may not only enhance productivity but also curtail profits. Since GVA partly reflect profit rates, these offsetting effects may blur the productivity enhancing effects. However, there is very little linear correlation between GVA and PCM. Thus, we could interpret the coefficients of competition and corporate governance variables as mainly reflecting their effects on productivity.

Figure 1 represents the time trends of competition variables from 1992-1993 to 2001-2003. We omit the data in 1991-1992 because the data in 1991-1992 is very few. It is seen that IMP edges up from 5.5 per cent in 1992-1993 to 10 per cent in 2001-2002. Conversely, HH gradually declines from 18 per cent in 1992-1993 to 13 per cent in 2001-2002. MS of sample firms also went down from 10.5 per cent to 7.5 per cent for the same period. These changes seem to reflect the effects of economic deregulations since 1991. With respect to RENT, which captures above normal rents, increased from 1992-1993 to 1995-1996 but thereafter remained low, though there were slight bounce backs in 1998-1999 and 2001-2002.

Figure 2 shows the time trends of DA with RENT. Since DA is a stock variable, whereas RENT is a flow variable, there does not need to be correlation between DA and RENT. However, we see reverse movements between them. Until 1995-1996, DA tends to decline whereas RENT goes up. Since 1996-1997, DA gradually accumulates, while RENT generally stays low.
These trends seem to indicate that throughout the 1990s product market competition gets intensified, including the competition from imports. Initially, after the beginning of economic reforms sample firms enjoyed higher rents, probably due to unreeaped economic opportunities. But after a while the rents tend to decline due to competition, and this may have caused accumulation of debt among sample firms.

We are interested in whether the intensification of product market competition and accumulation of debt/asset ratio have positive effects on productivity.

6-2. Estimation Results

Tables 2 and 3 show our estimation results. The results of Hausman tests indicate that fixed effects model is preferred for all the formulations except for a few cases whose results are not a part of our main results. All the formulations which we are interested in are in favor of fixed effects model. F tests show that the existence of individual firm effects is accepted against the hypothesis that constant terms are equal across firms.

The Results of Model 1

As regards the results of Model 1, the debt asset ratio has a statistically significant negative coefficient, indicating that debt asset ratio is negatively correlated with the level of productivity.

Among three competition variables, only import ratio, if any, seems to affect the level of productivity, but the coefficient is negative and significant only at 10 per cent significance level. This result arises probably because we cannot fully distinguish the effect of market competition on profits from that on the improvement of productivity. In the 1990s the regulations on trade were liberalized. Since our dependent variable (gross value added) could be correlated with profit rate, productivity may appear to have declined in the markets where higher competition from imports curtails the profits rate.

With respect to control variables, age and size variables are consistently statistically significant (at least at 10 per cent significance level). The results indicate that the level of productivity is likely to be high as firms get old, and as firms become large.

Based on these results it is reasonable to infer that market competition variables did
not influence the level of productivity in the 1990s, at least when we are concerned with
the short time span. We interpret these results as follows. A large part of the level of
productivity is the persistent effect of accumulated productivity growth. Thus, even if a
manager faces a high competitive pressure in a current period, his or her efforts cannot
realize quick effects on the level of productivity.

Moreover, it seems that above results in Model 1 reflect reverse causalities with respect
to the result of DA. If the productivity level of a firm is consistently low, then the firm
has to depend on debt rather than internal money, and debts accumulate in the long run.
Thus, a stock variable (debt/asset ratio) is negatively correlated with another stock
variable (level of productivity). In a similar vein, if the productivity level of a firm is
high, the firm would live longer and the firm’s size tends to become large. Thus the
effects of reverse causalities may also appear here.

The Results of Model 2

In contrast with Model 1, the debt asset ratios are far from being significant in all
formulations. This result indicates that the debt asset ratio does not restrict the
availability of necessary funds for productive investment. If so, then DA should also
have a negative coefficient in Model 2 as well as in Model 1. On the other hand, it does
not support the hypothesis that DA accelerates the growth of productivity by motivating
managers in fear of default, either.

If we estimate three competition variables separately, then the Hausman tests indicate
that RE models are preferred for the estimation of IMP (in column one) and HH (in
column two) variables. However, in those formulations neither competition variables
are statistically significant (IMP variable is negative and significant only at 10 per cent
significance level for fixed effects model). The R-squared are very low for these random
effects models, too.

For the estimation for the effect of MS in column three, the Hausman test implies that
we should choose FE model and MS’s coefficient is negative and statistically significant
at 1 per cent level. This indicates that a firm with a smaller market share tends to raise
productivity rapidly.

If we combine three variables all together, MS is still negative and significant in column
five. In this regression IMP is also negative and significant, indicating that as import ratio increases, the growth rate of productivity decline. A possible explanation is that domestic firms have not been able to withstand foreign competition. Thus the increase in import may have curtailed the growth of profit rates and also the growth of value added may have been reduced.

When interactive terms among three competition variables are included, the interactive term between HH and MS is positive and significant in column six. This indicates that as market concentration increases, the effect of MS on the productivity growth declines. In other words, in a less concentrated market, a firm with a smaller market share raises productivity more rapidly. If we could say that competitive pressure is high in a less concentrated market with each firm occupying a small market share, then our estimation indicates that product market competition will enhance productivity growth rates.

It is worthwhile to note that throughout the models HH variable is rarely statistically significant. The result is consistent with our claim that competitive pressure is firm specific, therefore the competition variable at an aggregated industry level does not well capture the extent of competitive pressure faced by each firm. Our result is in accord with Goldar (1986a, b), who obtains the result that concentration does not significantly affect the productivity growth.

7. Conclusion

In this paper we examine the effects of product market competition and corporate governance on the level and the growth rate of TFP. Our findings suggest that a firm with a smaller market share in a less concentrated market is likely to achieve higher productivity growth. Another implication of our empirical results is that a concentration ratio (Herfindahl index in this paper) is not a good proxy for competitive pressure that corporate managers would feel. Aggregate Herfindahl indices do not have a significant effect in this study.

Regarding the corporate governance related variable we tested the effect of debt asset ratio on TFP. It has a negative effect on the level and no effect on the growth rate of TFP. This result can be partially explained by reverse causality. However, the result is also in
contrast to other studies for other countries, where a positive association was reported. We could rationalize our results in terms of the lack of disciplinary roles under the government-controlled financial system in India.

Based on our empirical results, it seems that the liberalization of industrial regulations since 1991 is in the right direction. One concern is that in the 1990s large firms are becoming larger probably due to the relaxation of restrictions on former MRTP firms. The government could also reform the financial sector so that the managers of firms will be more disciplined by financial markets. Further privatization could be one option, but in terms of productivity, it is more important than privatization itself, to ensure that managers of firms make a greater effort under the pressure from financial markets.

Appendix

Real Capital Series

With a few differences we follow the method taken by Srivastava (2000). The replacement cost of the capital stock is calculated as,

\[ P_{t+1}^i K_{t+1}^i = \frac{P_{t+1}^i (1 - \delta)}{P_t^i} P_t^i K_t^i + P_{t+1}^i I_{t+1}^i , \]

where \( \delta \) is the depreciation rate, \( P \) is the price of capital, \( K \) is capital stock and \( I \) is investment. Although Srivastava divided capital into plant and machinery, buildings and other capital, we did not do so at this stage.

Implicit deflators for total capital formation are obtained from the National Account Statistics, in which a series are available for private sector capital formation at current and base year (1993-94) prices.

To obtain capital at replacement cost for the base year, Srivastava made three assumptions. We modified his assumptions to our setups as follows.

Assumption 1: No firm has any capital in 1991-1992 of a vintage earlier than 1976-1977. For firms incorporated after 1977 it is assumed that the earliest vintage of capital in their capital mix dates to the year of incorporation.
Assumption 2: The price of capital has changed at a constant rate at \( \Pi = P_t / P_{t-1} - 1 \) from 15 years before the initial year in the data or the date of incorporation of the firm up to 1991-1992 (or the initial year in the data). Values of \( \Pi \) were obtained by constructing capital formation price indices from the series for gross fixed capital formation in the National Accounts Statistics.

Assumption 3
Investment has increased at a constant rate for all firms and the rate of growth of investment \( g = I_t / I_{t-1} - 1 \). Here the rate of growth of gross capital formation at 1993-1994 prices is assumed to apply to all firms. Again, different average rates are obtained for firms established after 1977.

Under these assumptions, if the capital stock of the earliest vintage is \( \tau \) periods old, then the revaluation factor for gross fixed assets (\( R^G \)) is:

\[
R^G = \frac{\left( (1 + g)^{\tau+1} - 1 \right) \left( 1 + \Pi \right) \left( (1 + g)(1 + \Pi) - 1 \right)}{g \left( (1 + g)(1 + \Pi) \right)^{\tau+1} - 1}.
\]

Similarly, the revaluation factor for net fixed assets (\( R^N \)) is:

\[
R^N = \frac{\left( (1 + g)^{\tau+1} - (1 - \delta)^{\tau+1} \right) \left( 1 + \Pi \right)^{\tau} \left( (1 + g)(1 + \Pi) - (1 - d) \right) \left( 1 - \delta \right)}{(g + \delta) \left( (1 + g)^{\tau+1}(1 + \Pi)^{\tau+1} - (1 - d)(1 - \delta) \right)},
\]

where \( d \) is the rate of accounting depreciation and \( \delta \) is the economic rate of depreciation. As in Srivastava (1996) we used 7.1 per cent for \( \delta \). We calculate the average accounting depreciation rate for each firm for \( d \).

We apply these revaluation factors to the initial net fixed asset data in our data set, to obtain our estimated initial capital stock. After that we obtain the series of capital stock at replacement cost by the perpetual inventory method, mentioned above.

[Notes]
1. This reasoning is different from other reasoning such as economies of scale and
capital utilization. However, these factors could partly be explained by managers’ timely decisions, which can be included in managers’ efforts.

2. For instance, an answer to a question whether a firm has more than a certain number of rivals in its product market has been used in empirical studies.

3. Product portfolio analysis, such as growth-share matrix by Boston Consulting Group, provides a different perspective.

4. ICICI was merged with ICICI Bank in 2002.


6. Mitra (1999) also shows that during the pre-reform period from 1976 to 1992 the productivity growth rates differ depending on state or industry.

7. Banga and Sinha (2005) investigated the impacts of debt on various variables chosen by firms and their profitability. But they did not examine its effect on productivity.

8. However, the data in 1991-1992 is very few. Thus we could say that the data covers the period from 1992-1993 to 2001-2002.

9. The data on the lending rate of interest is obtained from International Financial Statistics, published by IMF.

10. This is the depreciation rate on capital, which is used by Srivastava (2000).

11. I intend to include R&D expenditure, advertisement expenditure, marketing expenditure, distribution expenditure. But these variables are far from being significant. Thus I do not report the results of the estimation including these variables. Furthermore, these variables are controlled by managers. Thus, they should reflect market competition and corporate governance.

12. Japan External Trade Organization annually conducts a questionnaire survey on Japanese firms investing in Southeast and South Asian countries. Last year about 60 per cent of Japanese firms in Singapore answered that very little room for reducing costs further remains.

13. The data on the number of mandays-employed is missing in ASI for 1997-1998. We first calculated the average ratios of mandays-employed / employees for the period from 1991-1992 to 1996-1997 for each industry. Then we multiply the data on the number of employees in 1997-1998 by this average ratio for each industry.

[Reference]


Economic Relations


The aggregated index of Herfindahl index of each firm, defined in the main text.

### Imp: The index of import penetration ratio faced by each firm, as defined in the main text

<table>
<thead>
<tr>
<th>Firm</th>
<th>Imp</th>
<th>MS</th>
<th>HH</th>
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<tbody>
<tr>
<td>A</td>
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Values in the parentheses are t-values. *** indicates significance at 1% level, ** 5% level and * 10% level.

LL: Log(Labor); LK: Log(Capital)

Age: The current year minus the year of incorporation

Size: Log(total assets)

DA: Total Borrowings/Total Assets

RENT: Earnings before taxes and interest payments, plus depreciation, minus the user cost of capital times (total debt + total equity), divided by total assets
Values in the parentheses are t-values. *** indicates significance at 1% level, ** 5% level and * 10% level.

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**IMP:** The index of import penetration ratio faced by each firm, as defined in the main text

**MS:** The index of market share held by each firm, as defined in the main text

**HH:** The aggregated index of Herfindahl index of each firm, defined in the main text.
Values in the parentheses are t-values. *** indicates significance at 1% level, ** 5% level and * 10% level.

DL: Growth rate of Labor; DK: Growth rate of Capital
Age: The current year minus the year of incorporation
Size: Log(total assets)
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