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**Divergence and Convergence of Firm-level Best Practices: the
Case of Bajaj and Hero-Honda in India's Two-wheeler
Industry**

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Abstract

Literature in economic development shows how countries diverge and converge in economic growth owing to technological change and capital accumulation. This paper examines micro-level issues of competitive rivalry of firms and consequent convergence of best practices. Multinational investment in developing economies is one of the means of technology in-flows. If local firms have a critical level of capabilities and are able to compete with multinational firms this can lead to convergence of best practices and consequent economic growth. Some of the propositions of the literature are empirically tested with the case of rivalry between a local firm and a multinational firm in India's two-wheeler industry for a period of 15 years.

Keywords: *Competitive Rivalry, Best Practices, Divergence, Convergence, Multinational firms, Local Firms*

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1. Introduction

In a recent book, Michael Spence (2011) discusses the new dynamics of convergence in economic development between developed and developing economies. In the historical context, around 1820 China and India accounted for 50 percent of the world income. Industrial revolution took place in England around 220 years ago and it spread within Western Europe, and to North America, Japan, Australia and New Zealand. However, it did not spread to countries such as China, India, African and Latin American countries. As a consequence, the West diverged in economic development while countries in the East declined economically except for Japan. Indian economy declined under the British rule (Clark and Wolcott, 2001).

Spence shows convergence of economic development between the developed and developing world for the last 40 years citing examples of China, India and Brazil. He attributes this to globalization and rapid flow of technological change across the globe. Most of the innovations take place in the developed economies with vibrant National Innovation Systems (Patibandla, 2006). One of the ways of technological in-flow is through multinational investment. Multinational firms (MNCs) enter emerging economies to take advantage of low cost skills for global markets and to cater to growing local markets. This is where the issue of convergence of technology becomes relevant. The optimal competitive response of local firms in a developing economy is to expropriate the public goods nature of new technology from the presence of MNCs and make efforts to imitate the best technology practices by importing from developed countries, buying licenses and adapt them to local conditions by dealing with codified and tacit elements of new technologies. If local firms are successful at this, there will be a process of convergence of best practices.

For local firms to catch up with MNCs in best practices requires two conditions. The developing economy must have a critical endowments of industrial, skill and technological endowments at the time of the reforms. Secondly, the developing economy must have a critical level of capitalist and political institutions which give level playing field to local and multinational firms. India meets these conditions (Patibandla, 2006).¹ This micro-level process of competition resulting in

¹ On the other hand, the Chinese government did not give private property rights to the Chinese private firms but gave property rights to multinational firms until 1998. The public sector firms were given high

convergence of best practices reflects in aggregate growth of an economy. I have considered micro level firm level practices in terms of strategic behavior, technology, and organization. In Section 2, I discuss basic concepts. In Section 3, I test some of the underlying propositions with the case of competition between a multinational giant Honda and an Indian firm Bajaj in India's two-wheeler industry.

2 Conceptual Issues

I take the approach that market share differences between two firms depend on strategic play and relative costs of production. Relative cost differences depend on technology and organization. The main proposition is that intense competition between oligopoly (duopoly) players in a well-specified industry could result in convergence of best practices in technology and organization. The following discussion shows the possible divergence and convergence in these elements.

2.1. Strategic Behavior

In the industrial organization literature, strategic behavior of firms is examined through applied game theory. The basic foundation of applied game theory is Nash games and equilibrium. If we consider the symmetric case, two agents play a one shot game by taking other's action as given and each agent does what is best for him/her without knowing other agent is doing the same. Pay offs are equal in equilibrium and there is no unilateral incentive for the agents to move from the equilibrium. Introduction of asymmetries such as time, one agent knowing the other's strategy and differences in costs are the basis of firm level relative advantages through strategic play (Dixit & Nalebuff, 2010; Brandenburger & Nalebuff, 1996). When we consider, Cournot-Nash competition in quantities, firms with different market shares can coexist in equilibrium. The differences in market shares are a result of relative advantages of firms in terms of their ability to internalize other firm's reaction function (Stackelberg), first mover advantages, and possessing superior technology and organization.

If one starts from an equilibrium in which firms with different market shares exist, convergence of a smaller firm (or a late entrant) to a larger firm depends on its ability to neutralize the relative advantage of the first mover firm through superior technology or product. In other words, an incumbent can be challenged by a new entrant with superior technology and

priority. The Indian government allowed MNCs through joint ventures in the 1980s, later these policies

organization. The theory helps in identifying the possible strategic choices for firms to convergence with the dominant firm.

On the other hand, large markets bring out forces for both divergence and convergence. For example, a large market with consumers with diverse preferences can give opportunities for firms to differentiate their products both on horizontal and vertical lines. An example of a rational divergence strategy is that a potential new entrant into a market is in a position to observe the choices already made by an incumbent and can seek to find a market entry by differentiating himself or herself from the incumbent by assessing the distribution of diverse preferences and abilities of buyers.

In management literature, the focus is on how firms derive competitive advantage and sustain it (Porter, 1980) which could be based on cost and differentiation strategies. Strategic groups framework (Porter, 1985) in management literature posits the existence of mobility barriers within an industry which are the *raison d'être* for the formation of strategic groups in the first place. These mobility barriers offer some degree of protection against competitive imitation and some insurance against the leakage of the resource and capabilities on which competitive advantages are built. Mobility barriers may be thought of as resource-based advantages enjoyed by firms that allow them to preserve some level of distinctiveness. Firms located in different strategic groups may confront mobility barriers in the short run that prevent them from imitating the strategies of their more successful rivals. Head on competition is thus reduced to competition with a smaller set of firms that occupy the same strategic group as the focal firm. For example, when Japanese firms entered the international markets for electronics and automobiles in 1950s and 1960s, they entered the strategic group of low-quality goods where there were low-entry barriers and later moved up on to the top level strategic groups which implies breaking-up of mobility barriers and converging with the best practices in an industry. Similar was the case of the South Korean firms since the 1960s.

2.2. Technology

As mentioned, one of the main sources of realizing higher relative efficiency is through technological superiority. In the Schumpeterian world of 'creative destruction', when a firm innovates in technology, products and practices, it generates turbulence in the market by taking

were removed.

away markets share from rivals. The optimal response of the rivals is either to imitate or innovate. Incentives for innovation emanate from the market and institutional conditions to internalize the rents. Larger is the imitation lag, higher are the rents. As discussed in the previous section, if two agents play Nash game, there is no unilateral incentive for any agent to move away from equilibrium unless there is an exogenous shock. An agent's incentive to invest in R&D and innovate has to be introduced by ad hoc assumption. One way we can resolve this is that under Nash-Cournot game, firms compete with R&D investments instead of quantity of output (Das Gupta & Stiglitz, 1980). R&D race goes on until a discovery is made. If we take the innovation as process innovation, the firm that makes the discovery will have lower costs and will have higher market share and profits in equilibrium. We take that the innovative firm is from a developed economy which enters a developing economy with the superior practice as MNC. Therefore the innovation comes to a developing economy exogenously. Firms in a developing economy take the superior practice of the MNC as given and make efforts at imitating it through strategic interaction.

The neo-classical growth theory (Solow, 1988) shows that economic growth is a function of technological change and capital accumulation. Technological change is taken as exogenously given. As physical capital is subject to diminishing returns, economies should converge in the economic growth which did not take place between the West and East for quite some time. As market structure is assumed to be perfectly competitive, technological change takes place at the industry level. The new-growth theory (Romer, 1990; Lucas, 1988) takes technological change as endogenous emanating from the private and public agents investments in human capital and R&D in response to incentives of markets and intellectual property protection. Investment in human capital is subject to increasing returns owing to learning economies. New technologies can be characterised by non-rivalrous and non-excludability conditions. Non-excludability implies new technologies have some public property characteristics and spill-overs (externalities) to other firms. Non-rivalry implies that use of a new technology or a blueprint (or a new idea) does not preclude others from its' use- there can be a simultaneous use by large number of agents.² The larger the number of users, the larger is its' aggregate value.

² As shown by Romer (1990) nonrivalry has two important implications for the theory of growth. First, nonrival goods can be accumulated without bound on a per capita basis, whereas a piece of human capital such as the ability to add cannot. Each person has only a finite number of years that can be spent acquiring skills. Secondly, a nonrival good besets knowledge spillovers which implies incomplete excludability.

International trade and investment increases the number of users. In general, in these models, general equilibrium is derived by taking market structure as monopolistic competition *a la* Dixit & Stiglitz (1977). Strictly speaking under monopolistic competition there is no strategic play between firms. In this paper we take a MNC enter a developing economy with a superior practice and a product which induces local firms to compete with MNCs strategically.

2.3. Production Organization

As mentioned, one of the main sources of efficiency of firms' is organizational efficiency. It is in terms of internal bureaucracy, vertical integration and diversification behaviour. Coase (1937) argued that a firm as an organization comes into existence to economize on transaction costs of markets. The firm internalizes economic activity until marginal internal bureaucratic costs of hierarchy are equal to the marginal transaction costs of the market (boundaries of the firm). Williamson (1985) conceptualizes differential transaction costs through the lens of contracts. They differ in three critical dimensions; frequency, uncertainty and asset specificity. All contracts are incomplete. It is not possible to incorporate all possible contingencies into a contract. The behavioural assumptions are bounded rationality and opportunism. Bounded rationality (Simon, 1957) refers to behaviour intendedly rational, but limitedly so owing to informational imperfections and cognitive abilities. Opportunistic behaviour is conceptualized in terms of self-interest with guile. In the *ex ante* stage of a contract, the market is competitive. Once two agents get into a contract, it becomes a bilateral monopoly. Guile implies that when contracts are incomplete, agents renege on their promises when the environment changes or when one realizes that the other party has invested in assets specific to the contract (locked-in). Given the differential dimensions of transaction costs, agents choose different governance structures; markets, hierarchy (integration), hybrids (such as franchisees, to some extent joint ventures) and public bureaus. For investments with high degree of asset specificity, the preferable governance is integration.

The new institutional economics shows dimensions and extent of transaction costs determined by the institutional environment- both formal and informal. Economic reforms in developing economies can be treated as parameter shifts in certain aspects of institutional environment

These two features of knowledge- unbounded growth and incomplete appropriability- cause long run sustained growth.

which allows entry of MNCs with superior technology and products. Local firms have to adapt to the new institutional environment and competition from MNCs. MNCs also have to adapt to the institutional environment of a developing country which are different from that of a developed country. MNCs may adapt certain elements of their organization to local institutions and at the same time bring-in superior organizational practices.³ An example is Japanese and South Korean companies' organizational practices such as vendor development which made Indian companies to imitate. This could trigger institutional change overtime.

Chandler (1977) showed that large integrated firms dominated most sectors in the US since the early part of the twentieth century. Large corporations enjoyed economies of scale and scope and an extensive brand image, and gave formidable competition to new entrants. The firms were vertically integrated because they were set up when the industry was young and very few suppliers of intermediate goods existed. As in Williamson's thesis, the suppliers could not be persuaded to set up units because all they could see for the forceable future was a monopolist buyer and investments with a high degree of asset specific investments. In the 1980s and 1990s, the organization of large corporations went through drastic changes with a process of vertical disintegration. One can argue that it was result of development of capital and intermediate input markets, increase in number of final producers and also induced by the entry of Japanese business groups in the global markets.

The Japanese firms adopted the lean production practices and developed the concept of outsourcing and supplier firms. Cost and quality advantage arising out of these practices made the Japanese auto-mobile and electronic companies shake up the world markets in the 1980s and 1990s forcing companies in the US and Europe to adopt some of the Japanese practices. Consequently, most companies in the US and Western Europe have become focused companies.

³ A good example is Toyota's plant, NUMMI (New United Motor Manufacturing Inc) in the US. When Toyota set up its plant in the US, it faced difficulty in adapting the Japanese organizational practices because of the differences in the institutional environments of the US and Japan. The long-term success of the Toyota plant in the US depended on its ability to combine some of its Japanese organizational practices with the organizational culture of the US in general. It has been observed that NUMMI successfully implemented its practices in the areas of work organisation, learning and human resource policy, while they made some adaptation in the area of employment relations and associated methods, which are influenced by the US institutional factors. This, in turn, resulted in competitive advantage of higher productivity at NUMMI in comparison to the American firms within the US (Adler, 1999).

⁴ As mentioned, the entry of Japanese companies such as Suzuki, Honda and South Korean companies such Hyundai into India led to development of supplier firms through sub-contracting which Indian firms such as Mahindra and Mahindra, Bajaj and Tata's imitated the sub-contracting practices to reduce costs.

There is no systematic theory to explain un-related diversification. Penrose (1959) shows that an entrepreneur or a manager acquires different resources and capabilities at different stages of a firm. In starting a firm, he/she needs project-implementation skills. Once the firm is established and starts to function, project implementation skills are no more needed. The manager can sell these resources or if he/she acquires strong advantage in these resources, he/she can use them to diversify into other areas. One good example from India is the highly diversified business group of the Reliance industries.

Khanna and Palepu (2000) extend the transaction cost logic to rationalize that diversification into unrelated areas in developing countries takes place for economizing on transaction costs of capital and labour markets. One could argue the other way round that capital market imperfections of better access and lower cost of capital to the family businesses compared to new entrants and smaller firms, and ability to procure contracts and licenses from government; help family businesses to increase diversification (Patibandla, 2006a). The diversified business groups can undertake cross-subsidization to compete in those areas where focused companies are highly competitive. If the transaction costs of the markets and capital market imperfections decline overtime, the diversified business groups lose their competitive advantage to focused companies. In other words, convergence of business organization may take place over times as capitalist institutions evolve.

3. Empirical Exercise

As mentioned, the main proposition of this paper is that intense competition between two firms in a well-specified industry leads to convergence of best practices. This paper examines this in the context of competition between a multinational and a local firm in India's two-wheeler industry. After following years of closed and protectionist policies since 1950, India started to implement policy reforms since mid-1980s. The policy reforms eliminated licensing policies of entry and expansions barriers. This helped local firms to expand capacities and import new

⁴ However, the Japanese and South Korean companies still remain diversified- a part of the explanation can

technologies. Secondly the reforms opened up some of its industries such as two-wheelers and electronics to multinationals in the mid 1980's. Until then, the two wheeler industry was dominated by an Indian firm, Bajaj. The Japanese Honda Corporation entered the industry in the mid-1980s with a joint venture with an Indian firm Hero whose earlier business was bicycle production. The competition process between these firms since then is an interesting case for the issue of convergence.

One can approach the issue of competition process by looking at: (1) exogenously given technological and organizational asset position of local firms at the time of the economic reforms of institutional change, and (2) multinational firms enter the industry in the second period (after the reform) with superior technology and products which could neutralize the first mover advantage of local firms. This triggers the competitive process between local firms and multinationals in the second period.

As mentioned in section 2.1, in sequential entry oligopoly models, given all other things equal, a first entrant will always have an advantage over a late entrant. First entrant will be a Stackelberg leader and the late entrant the follower firm. Furthermore, a first entrant can have advantages in lower cost of production because of internalization of learning economies. A new entrant can dislodge an incumbent firm by superior technology and product.

One can simplify the relative advantage of a MNC over local firms its superior technology and products, which provides them with a production cost advantage. Local firms' relative advantage can be simplified into their country-specific related institutional experience being the incumbents (first entrants). This aspect is germane to developing economies where markets are subject to complex and diverse institutional conditions. The different sources of relative advantages of MNCs and local firms at the starting point of the rivalry determine the differences in behavioural response variables of local firms and new entrants in the post-reform period and consequent convergence (or divergence) of the efficiency of the firms.

Relative production inefficiency of local firms was a result of operating in a highly protected Indian market with a high degree of market power for long in the pre-reforms period. The response of an

be drawn from the organization of their capital markets.

incumbent to the entry of more efficient MNCs in the post-reforms period is to sever itself from the past investments and adopt more efficient technologies and organisational practices.

On the technology front, most Indian firms were observed to have made minimal investment in R&D assets in the pre-reforms period (Patibandla, 2002). Generally, older vintage technologies were imported and minimal efforts were made in adapting them and building technological dynamism. Consequently, most Indian firms were far below the international technology frontiers. Most Indian firms have been family-run businesses with a highly centralised organisational structure. In the pre-reforms period, economising principle of designing organisational structure was not a major concern for Indian firms as they had access to a highly protected and non-contested home market. Indian firms appeared to have fondness for creating too many hierarchies- a part of the explanation can be drawn from the cultural factors. In a typical large Indian firm, hierarchy levels ranged between 15 and 20 categories and within six or five broad categories, there were three or four sub-categories (Patibandla, 1998). In response to competition from new entrant MNCs in the post-reforms period, local firms in India appeared to replace technological assets with less difficulty than organisational assets. Local firms adapted more efficient technologies through imports and increased expenditure on R&D.

Lower cost is necessary but not sufficient for a new entrant MNC to penetrate the Indian market when one brings in the institutional elements. New entrants' knowledge of or experience in dealing with Indian market institutions was negligible in the beginning of entry into the Indian market. This implies it takes time for a new entrant to penetrate Indian market irrespective of its superior technology and organisation. For example, replicating a local distribution network and building long-term relationship with vendor firms may take years for a new entrant. Local firms had an advantage over new entrant MNCs in their experience in dealing with Indian institutional conditions that still cause high market transaction costs. Local firms also cultivated long-term contract relations with dealers and vendor firms. In other words, investing in building distribution channels and dealing with India's institutions is more important for MNC than the local firm. In the long-run, the process of convergence is local firms improving upon their technological and organizational efficiency and MNCs acquiring local distribution and institutional knowledge.⁵

⁵ Local firms' ability to improve production efficiency is a result of the competitive rivalry and also spillover process (externalities) of the MNCs' operations in India. Property rights of intangible assets of

Data

Detailed firm- level time series data for these firms is collected from the Center for Managing Indian Economy (CMIE) for 15 years of 1989 to 2003. The data point is restricted 2003 because around that time the Indian government relaxed the policies towards multinational firms and allowed them to set up green field ventures. Around that time, Honda announced that it was breaking up its joint venture with Hero and it would be setting up its own green-field venture. I have measured a set of variables for the two firms to examine the competitive process and convergence of practices.

Variables:

TE: Technical efficiency of production. The methodology of estimating *TE* is shown in Appendix 2.

MS: Market shares of firms. Sales of a firm/Total industry sales

DIS: Distribution expenditure/Sales

ADS: Direct advertising expenditure/Sales

RDS: R&D expenditure/Sales

PLS: Plant and machinery /Sales

VI: Vertical integration (Value-added/Sales)

EXS: Exports/ Sales

IMS Imports/ Sales

AMS: Administrative expenditure/ Sales

D: Dummy variable that takes a value of 0 for Hero-Honda and a value of 1 for Bajaj.

The following presents the econometric explanation of Technical Efficiency (*TE*) variable by relevant explanatory variables. The results also show the differences in the behavioural response of the multinational firm and the Indian firm through competitive process which has been discussed earlier. Panel data fixed effects model is adopted for econometric estimation. It utilizes information on both inter-temporal dynamics and individuality of the entities being investigated, which controls for the effects of missing or unobserved variables.

MNCs are underdeveloped and as a result they are partially public goods. Others can use assets developed by one firm at a small cost.

$$TE = 0.69 - 0.1(D) + 21(RDS) + 0.10(IMS) - 0.9(AMS) - 39(D*RDS) + 1.2(D*IMS)$$

$$(9.0)^* \quad (0.5) \quad (1.9)^* \quad (1.0) \quad (1.89)^* \quad (2.1)^* \quad (1.46)^{**}$$

Adjusted *R-squared* = 0.12 *F* = 1.6 *N* = 30

Figures in the brackets are t-values. * Significant at 0.01; **at 0.05 levels

The above results have interesting implications for the basic arguments and underlying hypotheses of the paper. Statistically insignificance of the estimated coefficient of *D* implies there is no systematic difference in technical efficiency of the firms. The estimated coefficient of *RDS* variable is positive and significant which means higher the R&D investment higher is efficiency. Interactive variable of (*D*RDS*) and (*D*IMS*) variables are introduced to capture the differences in behavioural response the multinational firm and the Indian firm. The statistically significant negative sign of the estimated coefficient of (*D*RDS*) implies it is more important for multinational firm to invest in R&D to realize higher efficiency than for the local firms which is counter to some of the arguments of the paper. However, the statistically significant negative sign of (*D*IMS*) implies that it was more necessary for local firms to import technology and materials to achieve higher efficiency which supports the arguments of the paper. *AMS* variable captures internal organizational efficiency- higher the value of the variable lower should be firm level efficiency which is supported the results.

Methodology of Observing Convergence

Generally the issue of similarity among groups for a set of variables is observed through cluster analysis. However, cluster analysis is generally done for cross-sectional observations. It is difficult to examine the convergence overtime through cluster analysis. The objective of this paper is to observe convergence over time. For this reason, I have developed a time series methodology. For each variable, the differences between each observation of the two firms is taken and squared (to eliminate minus values) for 15 years. The time period is segregated into three segments with each one consisting of five time observations. I have measured the means (averages) of differences (squared) of each observation of the variables of the two firms for each period of consisting of five observations. If there is a convergence, the differences in values of the means of the variables should decline over first period, to second and third period. As shown in Table 1, there had been a significant decline in the differences in relative efficiency of production (*TE*) and corresponding market shares. In the case of the response variables of distribution, advertising and R&D to sales variables, there is an increase in the differences from

period 1 to period 2, but there is no noticeable decline from period 2 to period 3. Similar is the case with respect to plant and machinery to sales, administrative expenditure and the organizational choice of vertical integration. Overall statistics show there had been a noticeable degree of convergence of the basic characteristics of the competing local firm and the MNC.

In qualitative terms, most Indian firms were highly vertically integrated prior to the entry of Japanese and South Korean firms. The Japanese firms (Maruti) Suzuki in four-wheelers and Honda in two-wheelers brought in the Japanese practices of development of supplier firms and outsourcing. Maruti-Suzuki was able to develop local suppliers rapidly because small local firms that could function as suppliers already existed, but their technological capability was below requirements. It brought about a significant transfer of technology and continuous assistance to its key suppliers. It arranged joint ventures between local suppliers and Suzuki suppliers in Japan. Suzuki encouraged its Indian suppliers to improve quality, price and delivery and made to adopt JIT (Just in Time) (Patibandla, 2006).

The Japanese practices of vendor development were copied by Indian firms such as Bajaj in two-wheelers and Tata Motors and Mahindra and Mahindra in four-wheelers. Bajaj started to outsource 60 percent of its component needs in the early 1990s to about 300 firms. Later, however, it reduced the number of suppliers to 200, developing long-term relational contracts with the fewer suppliers in order to reduce transaction costs and to deal with increasing technological complexity of the product. I do not discuss diversification behavior as the two firms in consideration are more or less focused companies.

Table 1: Convergence

Bajaj and Hero-Honda: Two-wheeler Industry

Time	<i>TE</i>	<i>MS</i>	<i>DIS</i>	<i>ADS</i>	<i>RDS</i>
1.1989-93	48.93 (6.22)	17.68 (4.25)	0.0016 (0.0008)	0.0067 (0.0063)	0.0002 (0.0002)
2.1994-98	40.19 (6.72)	14.18 (3.6)	0.003 (0.001)	0.005 (0.005)	0.0005 (0.0005)
3.1999-03	17.71	7.35	0.002	0.0059	0.0004

	(19.46)	(5.92)	(0.001)	(0.0004)	(0.0001)
	<i>PLS</i>	<i>VI</i>	<i>EXS</i>	<i>IMS</i>	<i>AMS</i>
1 1989-93	1.48 (1.71)	7.43 (1.51)	0.046 (0.046)	0.998 (1.72)	0.009 (0.012)
2 1994-98	2.83 (1.73)	8.02 (2.75)	0.013 (0.012)	0.579 (0.423)	0.019 (0.012)
3 1999-03	2.09 (0.64)	4.09 (3.46)	0.024 (0.019)	0.91 (0.71)	0.014 (0.003)

Figures in the brackets are standard deviations.

Based on my qualitative discussions with a few executives of Bajaj, I briefly discuss the response process of the local firm Bajaj in improving technological and organizational efficiency in response to competition from Hero-Honda. Bajaj sourced technology and licences from Austria, Italy and Japan. It augmented in-house investment in R&D. In order to deal with the tacit elements of technology transfer, it took a group of its engineers to plants abroad to get first-hand learning of the new advanced technologies. It undertook organizational restructuring for adaptation of the technology and achieving operational efficiency. The new organizational approach is shifting from a top-down approach, typical of a family-run highly centralized organization, to a bottom-up approach. On the shop floor, workmen and section managers are grouped into cells and the members are guided by the self-management approach. All the cells were interlinked for a smooth information flow and coordination system. Nearly five thousand workers were given voluntary retirement. Manpower productivity in terms of the number of vehicles produced per man-year improved by 88 per cent between 1988 and 1998 (Bhudiraja et al 2003). The company developed selective vendor firms for the supply of specific components with long-term contracts and facilitated joint ventures with overseas firms for technology development. In the late 1990s, when consumer preferences shifted away from scooters to motorcycles, the company was able to adjust by developing motorcycle models. By the early 2000s, Bajaj, which had almost lost out to Hero-Honda, was able to derive a relative advantage over the MNC owing to its focus on cost efficiency and its responsiveness to market trends. On the other hand, Hero-Honda depended on the home R&D base in Japan for technology, which hampered quick response to market trends. Bajaj was able to respond swiftly to market trends,

able to introduce an entire range of two-wheeler models. In the process, it was able to launch innovative product developments such as two-wheeler model hybrids between motorcycles and scooters to cater to the consumer preferences in India.

There is evidence on convergence of product differentiation strategies of the two firms. Prior to the reforms, scooters, manufactured by the Indian firm, Bajaj were predominant in the market. In the post-reforms period, Honda introduced motorcycles using Japanese technology. As mentioned before, Hero-Honda grew rapidly taking away the market share from Bajaj. In the middle of the 1990s, consumer preferences shifted away from scooters to motorcycles, giving an advantage to Hero-Honda with 4-stroke motorcycles. Bajaj invested in R&D and developed 4-strokes engines imitating Hero-Honda. Bajaj Pulsar motorcycle models were able to gain market share at the expense of Honda's Splendor. Honda on the other hand was able to break the Bajaj stranglehold over the economy segment. Honda's CD Dawn took the market share from the Bajaj's Boxer. By the year 2004, the model sold by both the firms looked quite similar in characteristics and features with close range pricing.

4. Conclusion

Globalization and high-speed international flows of technological changes have been one the reasons for a few developing countries to increase their economic growth rates. MNCs investment in developing countries is one the ways of transmission of technology and best practices of firms. If a developing economy has a critical industrial, skill and technology endowments and local firms are able to compete with MNCs, this results in micro-level convergence of best practices. This reflects in aggregate economic growth rate of developing countries.

In this paper, I have examined micro-level process of competition between a local firm and a MNCs and consequent convergence of technological and organizational practices and consequent relative efficiency between a local firm (Bajaj) and a multinational firm (Hero-Honda) in India's two-wheeler industry. Some of the underlying propositions are empirically tested with econometric explanation of relative efficiency and a simple statistical methodology of convergence of the practices and consequent convergence of the relative efficiency. Results show there is a process of convergence of the practices between firms over the time period. The results of the paper have general implications. There is increasing evidence of local firms from

countries such as China, India and Brazil competing effectively with MNCs from advanced countries and they themselves becoming multinational players in the global market (Guillen and Garcia-Canal, 2013).

As a developing economy grows, income levels and market size increase which augment scope for technological specialization and trade. As economy becomes broad-based with increase in incomes and market expansion and diverse preferences of consumers and technological maturity, there will be emergence of market forces that cause the cycles of divergence and convergence of practices through innovation and imitation processes.

Appendix: Measurement of *TE*

Firm-level efficiency indices are measured on the basis of Farrell's (1957) production frontier approach. Developments in the efficiency frontiers literature show the derivation of plant-specific time-variant technical efficiency indices by using panel data. The production function defines the maximum possible output a firm can realize for a given level of inputs employed and the technology level. Farrell's method shows relative technical efficiency as the extent of deviation of output realized by a firm (for a given level of inputs employed) from the best practice in an industry.

The panel data techniques of measuring efficiency overcome several well-known shortcomings of the estimates based on cross-sectional data (see Pitt and Lee, 1981). The panel data capture cross-sectional information of firms in an industry and also repeated observations over time for a given firm. This, in turn, overcomes the shortcomings of strong distributional assumptions about composed error terms. Furthermore, this method does not impose the assumption that technical efficiency is independent of factor inputs.

By taking the Cobb-Douglas functional form, I can represent the technology as follows;

$$Y_{it} = \alpha + \beta X_{it} + v_{it} - u_i$$

where Y_{it} is the observed output, X_{it} is a vector of K inputs: i index firm ($i=1\dots N$): t index time ($1\dots t$). α and β are the unknown parameters to be estimated. v_{it} represents random errors. u_i ($u_i \geq 0$)

represents technical inefficiency with one-sided distribution which means that output must lie on or below the frontier.

The random error v_{it} is assumed to be identically and independently distributed across firms and time with identical zero mean and constant variance. It is also assumed to be un-correlated with factor inputs. The other error component, u_i , is assumed to be independently and identically distributed across plants with mean m and variance s_m^2 . I can rewrite the above equation as

$$Y_{it} = (\alpha - u_i) + \beta X_{it} + v_{it}$$

Cornwell et al (1990) introduce a parametric function of time into the production function to replace the coefficient of plant-specific technical efficiency. The functional form is

$$Y_{it} = X_{it}\beta + \alpha_{it} + v_{it}$$

Where $\alpha_{it} = w'_{it} \theta_i$, $w' = (1, t, t^2)$, $\theta_i = (\theta_{i1}, \theta_{i2}, \theta_{i3})$; and other variables are as defined before.

The model allows the rate of productivity to vary over time and firms. The production function can be estimated by OLS, which is referred to as the 'within estimator' in the literature. The residuals of the estimated function are used in deriving the efficiency indices. OLS estimation of the production function can be justified in terms of the Zellner-Kmenta-Dreze proposition that, under the assumption of maximization of expected profits, the explanatory variables and the disturbance term are un-correlated. However, α'_{it} is not consistent as T goes to infinity if factor inputs are correlated with firm and time specific effects. Under these conditions, the consistent estimators of α'_{it} , as time goes to infinity, can be derived by estimating the equation using OLS directly. The production function is estimated by the two input Cobb-Douglas production functional form with value-added as output, and L (salaries and wages) and K (rental value) as inputs normalized by appropriate prices.

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