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# Identifying High Growth Firms in India: An Alternative Approach

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Abstract

Over the past two decades, considerable interest has grown in high growth firms (HGFs). However, the concept of HGFs still remains controversial. One of the most controversial issues is size and age of these firms. The present study argues that the current literature on HGFs may offer little help in addressing this issue given the constantly changing population of HGFs. This study uses an alternative conceptual framework and proposes a concept of ‘High Impact Group of Firms’ (HIGF). It explains the HIGFs in the framework of a new stream of literature that focuses on business dynamics, productivity growth and industry evolution, formulates testable hypotheses, and uses a novel methodology to identify it. The empirical analysis is based on the plant level panel data of 22 manufacturing industries in Indian manufacturing during the period 2000-01 to 2005-06. Our empirical results reveal that much depends on the industry/sector specific characteristics.

JEL: L25, L26, O14, O33, O53

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## 1. Introduction

For decades, small businesses have been viewed as engines of growth by policy makers across the world. This has resulted in various policy initiatives aimed at providing them with business support to stimulate economic growth through them. These comprise of infrastructure development, tax incentives, concessions, favourable regulations and other special programmes. However, in his seminal work, Birch (1981, 1987) revealed that within the small sector it is a small group of high-growth firms that accounts for disproportionately large growth and employment as opposed to a large majority of enterprises that fail to grow. He coined the term ‘gazelles’ for the former and “mice” for the latter. He also found that large enterprises, ‘elephants’ in his analogy, make a negative contribution to net job creation. Since this pioneer work of Birch, the concept of “high growth firms” (henceforth HGFs)/gazelles has received considerable attention from policy makers and researchers. While few dispute the role of HGFs in employment and growth generation the likelihood of their being small has been widely questioned in the literature. While some find that these are small firms and small establishments (Neumark et al 2011), others indicate that these firms are young but not necessarily small (see *inter alia* Haltwinter et al 2012, Henrekson and Johansson, 2010). Some go a step further and suggest that these firms are neither small nor young, rather they tend to be more matured and larger (Acs et al., 2008; Mason and Brown, 2010; Brown et al (2014). Some research summaries conclude that HGFs include all types of firms: established, start-ups, small, and large ones (Audretsch, 2012; Nesta, 2009; Coad et al, 2014). These contradictory observations send confusing signals to policy makers, who seek guidance in picking winners with a focus on accelerating economic growth and job creation by promoting them. A major reason for the controversy is ‘definitional ambiguity’ that surrounds the concept of HGFs. There are usually two different approaches to define HGFs (see, Coad et al 2014 for a recent literature survey). The first is to define them as the top X% of firms in a population in terms of the selected growth indicators. The second defines them as firms growing at or above a particular rate between a start and end year, or on annual basis over a specific number of years[2]. Both these approaches are subject to ambiguities that arise due to the choice of growth indicators, measure of growth indicators (relative/absolute)[3], type of growth (organic or through acquisition), and a threshold level of growth rate. The results are found to be highly sensitive to these choices (Coad et al, 2014; Delmar et al., 2003; Daunfeldt et al, 2012; Henrekson and Johansson, 2010; Halvarsson, 2013 for surveys). While analysing the impact of the methodological choices on the identification of HGFs, Delmar et al (2003:100) conclude “what a high growth firm is, conceptually and operationally, is very dependent on the growth measure used”. Another reason for the controversy regarding their being small, new or matured firms, is that ‘high growth’ is not a characteristic of a specific set of firms. Rather, it is a phase in the life cycle of a firm which may not be persistent over time (Coad et al. 2014:99). Brown et al (2014: 5-6) view high growth phase as ‘episodic’ and ‘a state that some firms undergo and temporarily experience’. This means that the population and hence, characteristics of HGFs may constantly change. There are thus concerns that the concept of HGFs as defined in the existing literature may have little value for public policy making. An important policy question is how to best identify and target them.

The present study addresses this question. It offers an alternative perspective on HGFs and

[2] According to OECD (2007), for instance, “all enterprises with average annualized growth greater than twenty percent per annum, over a three-year period, and with ten or more employees at the beginning of the observation period are high growth firms”.

[3] Small firms are found to be overrepresented among HGFs when growth is measured in relative terms, but, large firms are more likely to be HGFs when growth is measured in absolute terms (Delmar et al., 2003).

uses a novel methodology to establish their likelihood of being small, young or established firms. Instead of focusing on 'individual HGFs', we identify 'population/groups of firms' which might have a high potential of propelling productivity growth. Further, our criterion of selection is not based on a threshold level of performance of firms or a group thereof. Rather, we identify high potential or high impact group/s of firms on the basis of their contribution to macroeconomic growth potential in terms of productivity growth[4]. We draw on the Industrial organisation (IO) literature on 'business dynamics, firms' heterogeneity, and macro level productivity growth' to explain the phenomenon of 'high impact group of firms' (HIGFs) within the overall framework of business and productivity dynamics. The argument runs like this: the business landscape is not static. It is constantly undergoing changes due to a process of churning of firms in which a large number of new firms appear each year; while many others go out of business. These business dynamics are closely associated with macroeconomic productivity dynamics due to considerable heterogeneity across new entrants, incumbents and exitors in terms of their productivity. More efficient firms grow rapidly to crowd out the less efficient ones pushing up the aggregate productivity growth levels to drive industrial evolution and economic growth. The research question is: Which set of firms is more likely to account for most of the productivity growth? Are they new firms? Are they small incumbent firms (gazelles)? Or, are they matured established firms? Theoretical literature is ambiguous and does not rule out any possibility. Following the literature on 'firms level heterogeneity and macro level productivity dynamics' we use the typology that characterises firms by their stage of growth, and formulate testable hypotheses. These hypotheses are tested using the decomposition methodology of aggregate productivity growth pioneered by Baily et al (1992) and subsequently developed by important contributions of several scholars (Griliches and Raves, 1995; Foster et al, 2001; Balwin and Gu, 2003; Olley

[4] Earlier Acs et al (2008) also referred to HGFs as high impact firms but this was because they defined them in addition to revenue growth by employment growth as well.

Pakes, 1996; and Melitz and Polanec, 2009). These methodologies use the plant level data to avoid the problem posed by multi-plant firms and break down aggregate productivity growth into the contribution of entering, incumbent, and exiting plants with direct implications for firm level analysis. We extend these methodologies by adding more categories of firms for the analysis and use the hitherto unexplored plant level data on Indian manufacturing for the period from 2000-01 to 2005-06. This is a unique dataset that provides us an opportunity to distinguish between rapidly growing small firms (gazelles), new entrants and large firms. The analysis focuses only on the manufacturing sector but will have implications for other sectors as well. The manufacturing sector itself is highly diverse and comprises of a range of industries which may be grouped into various subsectors. In the literature, different typologies have been used to classify the sector. We identify three subsectors for the analysis based on their factor intensity. These are: labour intensive, resource intensive and technology intensive subsectors. We expect that they will differ in terms of business and productivity dynamics.

The study makes three important contributions to the existing literature. One, we propose the notion of ‘high impact group of firms’ (HIGFs) as an alternative to HGFs. While the current studies identify individual HGFs on the basis of their performance over a given period of time and establish their importance by analysing their contribution to macroeconomic growth, we identify a high impact group of firms on the basis of its contribution to the macroeconomic growth potential of an economy. Two, we explain the likelihood of HIGFs being small, new or matured, within the theoretical framework of IO literature. The existing HGF literature is essentially built upon the insights provided by empirical observations. There is little theoretical support for these observations. We draw on the theories of firms’ heterogeneity, productivity dynamics and industry evolution to explain the phenomenon of HIGFs. Finally, we extend the existing literature by bringing emerging economies within its fold. While focusing essentially on OECD countries, the existing literature places too much emphasis on job creation. However, from the perspective of emerging economies, emphasis should be placed not on increasing employment levels *per se* but on increasing high quality productive employment. This view emphasises that job creation, linked to increased productivity is the central mechanism which can translate economic growth into increased incomes and improved social well-being. Even in the OECD country setting, many researchers have recently questioned the exclusive focus on employment growth (Aiginger, 2006, 2007; Bravo-Biosca, 2010: 16) with little attention paid to the quality of employment. Our approach of focusing on the role of HIGFs in accelerating macro productivity dynamics is consistent with this view.

India presents a good case study for this analysis because it is an emerging economy that has relaxed its policy related entry barriers substantially over the past two and a half decades. Since 1991, it has undergone comprehensive reforms in industry, trade, financial and fiscal sectors to improve efficiency, productivity and international competitiveness of the industry and to impart dynamism to the overall growth process. Evidence suggests that these reforms have had a significant impact on business dynamics in the industrial sector in terms of the number of entry, and growth in assets, sales and profits (Mody et al, 2010; Aghion, 2005; Alfaro and Chari, 2009; Bertrand et al, 2002; Rodrik and Subramanian, 2004; Kohli, 2006; Panagariya, 2008; Bhaumik et al, 2009). This study exploits these dynamics to gain an understanding of high impact firms in the context of a developing country.

The rest of the paper comprises of six sections. The following section sets out the theoretical underpinnings of the analysis and formulates testable hypotheses. Section 3 discusses the methodology for the empirical analysis while Section 4 describes the data. Section 5 highlights some of the discernible patterns of business dynamics in Indian manufacturing to set the stage for discussing empirical results in Section 6. Finally, section 7 concludes the analysis.

## 2. Business dynamics, firms' heterogeneity and productivity growth: A Theoretical framework

The literature on industry dynamics can be traced back to Gibrat's law of proportional effect (Gibrat, 1931). According to Gibrat, there is no systematic relationship between firm growth and firm size. This means that firms grow at the same average proportionate rate irrespective of their size. He argues that new opportunities arise in each period and the probability with which a firm exploits them is proportional to its size. This law is not found valid by most studies that followed. But, it generated considerable literature on 'firm growth' (Sutton, 1997). From the perspective of the present study, two strands of literature are of particular interest that link firm dynamics with business dynamics and macroeconomic productivity growth. These are: selection- based and innovation (entrepreneurship) - based theories of firm growth. The former can be attributed to Jovanovic (1982) while the latter is rooted in Schumpeter (1934, 1942). In his theory of firm selection and industry evolution, Jovanovic (1982) postulates that heterogeneous firms enter the industry without knowing what their relative efficiency is. Once they enter the market, they learn about their ability to manage the firm, from noisy information based on the distribution of their realized profits. If they find that their ability exceeds their initial expectations, they expand the scale of their business otherwise they contract it and may even exit. Thus, the Jovanovic's model is a theory of noisy selection, where efficient firms self-select them to grow rapidly, and inefficient firms decline and fail. There is a threshold rule for exit decisions: firms exit if they believe to be below the cut-off. As a result, bigger firms are less likely to exit. The central hypothesis of this theory is that the young and smaller incumbents are likely to grow faster than the entrants or larger and matured firms but they are also more likely to exit.

This theory has been enriched by a series of contributions with alternative assumptions (see Sutton, 1997). In one of the influential studies, Pakes and Ericson (1989) waived the Javonvic's assumption that firms learn passively about investment and innovations. They assumed that firms actively invest in exploring profit opportunities in an evolving market place. They find that success is not guaranteed by this proactive approach of investing in learning. If firms survive they grow and enter in larger classes.

Another strand of literature which is rooted in the Schumpeter's creative destruction process (Schumpeter 1934, 1942) argues that entry by innovative entrepreneurs is the force that drives industry's productivity and destroys the value of established companies that have enjoyed some degree of monopoly power derived from previous technological, organizational, regulatory, and economic paradigms. This line of argument has been carried forward in a new stream of literature (*inter alia*, Caballero and Hammour, 1994; Campbell, 1998) which argues that new technology is embodied in a more recent vintage capital. This is because unlike incumbents, new firms do not have to incur the costs of upgrading their capital. New companies are essentially created to exploit a new technological/marketing opportunity that is not detected or met by other firms and they can better harness new technologies. As a result, they are more productive. Their entry drives productivity growth at the aggregate level and displaces outpaced establishments. Melitz (2003) assumed monopolistic competition in a general equilibrium setting under the conditions of uncertainty to analyse productivity effects of firms' dynamics under international trade. His analysis indicates that an open economy induces entry by only those firms that have productivity greater than the threshold level. This forces the least productive firms to exit. Overall, this stream of literature proposes that new entrants are likely to be more efficient than the incumbent firms.

From the perspective of the literature on Strategic Management, however, growth is a path dependent process and implies a gradual accumulation of new resources and capabilities over a long time (Penrose, 1959; Hall, 1993; Mosakowski, 1993). Using the theory of business and productivity dynamics, Cooper, Haltiwanger and Power (1999) argue that when new firms enter with new technology, existing firms also adopt new technology by retooling. This in turn may drive the productivity growth of incumbents also. Incumbents are thus likely to grow rapidly in the face of new entry. Most existing studies also show that the established and matured firms are instrumental in driving the aggregated productivity growth (Aggarwal and Sato, 2011, for a literature review). Aghion et al. (2009) however find that the impact of entry on productivity dynamics of incumbent firms depends on the industry level technological advancement. If the incumbent is close to the technology frontier, it will also innovate more to grow fast and escape entry. This is more likely to happen in technologically laggard industries. But, if the incumbent is farther from the frontier, he cannot compete with the entrant and will have to contract or even exit. Thus, in technological advanced industries, new firms are more likely to drive productivity than in technologically laggard industries. While supporting this line of argument, the proponents of 'product life cycle' approach (Gort and Klepper, 1982; Cohen and Klepper, 1996; Geroski, 1995) argue that a young industry is characterised by high entry rates as new firms propose a large number of new product designs. As the industry matures, firms stop competing in terms of product design and start competing in terms of prices and costs. Entrants may be at a severe disadvantage in the latter type of competition and consequently their impact on industry structure and performance decreases. New entrants can thus be considered to be important agents of change in a high tech young industry. They can crowd-out less competitive incumbent firms through increased competition and /or stimulate incumbent firms to innovate themselves. We thus have four competing hypotheses:

H1: Smaller and younger firms are more likely to form a high impact group of firms (HIGFs) than their new and established counterparts.

H2: New firms are more likely to be the drivers of industry productivity and are more likely to constitute a HIGFs .

H3: Incumbents are more likely to be a HIGF and drive aggregate productivity

H4: Technological characteristics and maturity of the industry matter. Incumbents are more likely to constitute a HIGFs in technologically laggard firms while new entrants are expected to propel productivity growth in high tech industries.

In what follows, we test these hypotheses using non-parametric productivity decomposition methods.

## 3. Methodology

Empirically, the micro dynamics of macro productivity growth are captured by productivity decomposition methodologies which decompose macroeconomic productivity growth into the contribution of incumbents, entrants and exiting firms. The contribution of incumbent firms is further broken down into two components: pure productivity effects and reallocation of shares from more productive to less productive firms. Baily et al. (1992) was the first study to propose this type of decomposition methodology. It was followed by a number of alternative decompositions. We propose to use this methodology for our analysis. For ensuring robustness of our conclusions we use three main variants of this methodology in our analysis. These are: Griliches and Regev (1995), Foster, Haltiwanger and Krizan (2001), and Dynamic Olly and Pakes by Melitz and Polanec (2009); henceforth, GR, FHK and DOP respectively. Considering the problems involved in the classification of multi plant firms by stage of growth, the methodology is applied to plant level data with direct implications for firms. It must be noted that we shall be using ‘plants’ and ‘firms’ interchangeably in the rest of the analysis.

Foster, Haltiwanger and Krizan (2001) defined aggregate productivity as the output-weighted (θit) average of the productivity of individual plants. The linear aggregation of productivity implies a geometric average of productivity levels:

$$A_t = \sum_{f}^{n} \theta_{f,t} A_{f,t}$$

$A_{f,t}$ is the productivity for factory f in t, and $\theta_{f,t}$ is the output-share-weight for factory f in t. Using this, they proposed the following methodology, to decompose aggregate productivity growth:

$$\Delta A_t^{FHK} = \sum_{f \in S} \theta_{f,t-1} \Delta A_{f,t} + \sum_{f \in S} \Delta\theta_{f,t} \left(A_{f,t-1} - A_{t-1}\right) + \sum_{f \in S} \Delta\theta_{f,t} \Delta A_{f,t} + \sum_{f \in N} \theta_{f,t} \left(A_{f,t} - A_{t-1}\right) + \sum_{f \in X} \theta_{f,t-1} \left(A_{t-1} - A_{f,t-1}\right)$$

In the above equation S, N, and X, represent the sets of incumbents, entering, and exiting factories respectively, during the periods from t-1 to t; and a delta the change. The first term measures the contribution of the incumbent firms on productivity changes, weighted by the initial year share. The second term which sums changes in shares using a plant’s productivity as weight captures the reallocation effect amongst established firms. The third term is the covariance effect, which will be positive if firms increasing their productivity also capture more market share over time. The last two terms capture productivity growth accounted for by new and exiting plants respectively. All productivity changes are expressed as differences from aggregate productivity in $t-1$. In this methodology referred to as FHK, an entering plant contributes positively only if it has higher productivity than the initial average and an exiting/new plant contributes positively only if it exhibits productivity lower/higher than the initial average.

An alternative methodology is provided by Griliches and Regev (1995). Their methodology, referred to as GR is as under.

$$\Delta A_t^{GR} = \sum_{f\in S} \bar{\theta}_f \, \Delta A_{f,t} \quad + \sum_{f\in S} \Delta\theta_f \left(\overline{A_{f,t}} - \bar{A}\right) \quad \sum_{f\in N} \theta_{f,t} \left(A_{f,t} - \bar{A}\right) \\ + \sum_{f\in X} \theta_{f,t-1} \left(A_{f,t-1} - \bar{A}\right)$$

In this formula a bar over a variable indicates the average of the variable over the base and end years. All productivity terms (except for within-effects) are expressed as average productivity of two years. Thus, the average aggregate productivity level between the two periods is used as the reference productivity level in this methodology unlike the FHK which uses productivity of the initial period as the reference. The first term represents the contribution of the established and matured firms, where firm level productivity changes are weighted by their average market share across periods. The second term measures the importance of reallocation, which reflects firm level changes in market shares, weighted by the deviation of productivity from the industry mean. This will be positive if firms with high productivity capture more market share whilst low productivity firms shrink. The third term measures the contribution of entering firms, which is the sum of the deviations of entrant's productivity from the industry mean, weighted by market shares. Analogously, the fourth term measures the contribution of exiting firms.

A third methodology is offered by Melitz and Polanec (2009) who extended the decomposition methodology of Olley and Pakes (1996) and named it 'Dynamic Olley and Pakes' (hereafter DOP). It is given by,

$$\Delta A_t^{DOP} = \Delta\widetilde{A_{S,t}} + \Delta\mathrm{cov}(\theta_{S,t}, A_{S,t}) + \theta_{N,t}\big(A_{N,t} - A_{S,t}\big) - \theta_{X,t-1}(A_{X,t-1} - A_{S,t-1})$$
$$\text{where } \widetilde{A_t} = \frac{1}{n_t}\sum_{i=1}^{n_t} A_{f,t} \text{ and } \widetilde{\theta_t} = \frac{1}{n_t}\sum_{i=1}^{n_t} \theta_{f,t}.$$

In the above, $\theta_{g,t}$ and $A_{g,t}$ represent the aggregate market share and aggregate productivity of group g in period t. The contribution of incumbent firms is simply the aggregate productivity that would have been observed absent entry and exit. The set of incumbent firms is used as a benchmark for estimating how the group of entrants (or exitors) affects the aggregate productivity change.

Mathematically, the three methodologies may yield very different results depending on features of firm dynamics in the data. In an industry where the productivity of incumbent firms is growing, FHK decomposition yields lower contribution of exiting firms than the DOP, whereas the opposite holds for the GR decomposition. Further, both FHK and GR decompositions yield smaller contribution of established plants and larger contribution of new plants as compared with DOP. Finally, the contribution of established firms are inflated in FHK and GR due to the use of weights in measuring these effects, which according to Melitz and Polanec (2009) captures a part of reallocation effect. According to Mason (2014) however, the reallocation based contribution in DOP is highly inflated at the cost of the established firms' contribution. The former 'does not just capture resource reallocation but also moves in line with changes in productivity performance at firm level even when no reallocation of resources has occurred (for example, when rapid productivity growth takes place within large firms).

Clearly, the three methodologies are expected to yield different results. Since the results are sensitive to the choice of methodology we have used all three of them to ensure that our conclusions are robust. Since our analysis required some additional categories of firms to be included in these methodologies, we have extended the existing classification of firms by a more elaborate one which includes: large incumbents, new entrants, and small incumbents, switching-in large incumbents, switching-out large incumbents[5], and exiting firms. We analyse the contribution of each set of business firms. The analysis is conducted for the total manufacturing sector and three sub-sectors, namely, labour intensive, resource intensive, and technology intensive, separately. Finally, productivity is measured using both, labour productivity (LP) and total-factor productivity (TFP) measures. The aggregate LP is measured as a weighted average of plant-level productivity. It is defined as

$$LP_t \equiv \sum_{f}^{n_t} \theta_{f,t} LP_{f,t} = \sum_{f}^{n_t} \theta_{f,t} \left(\frac{GVA_{f,t}}{L_{f,t}}\right)$$

The aggregate TFP is defined as

$$TFP_t \equiv \sum_{f}^{n_t} \theta_{f,t} TFP_{f,t} = \sum_{f}^{n_t} \theta_{f,t} \left(\frac{GVA_{f,t}}{K_{f,t}^{\hat{\alpha}} L_{f,t}^{\hat{\beta}}}\right)$$

[5] See, Table 2 for definition.

*Where*, $\theta$ is weight in terms of 'output'[6], GVA is 'Real Gross Value Added' which is calculated using a double-deflation method. This means that both 'gross value of output' and 'inputs' are deflated by their respective price indices[7]. More specifically,

GVA= (gross value of output)/ (wholesale price index)-(total input)/ (input price index).

Further, L is man-hours of workers, and K is defined as the initial value of net fixed capital deflated by the implicit deflator of net capital stock in the organized manufacturing sector. Finally, the parameters $\hat{\alpha}, \text{and } \beta$ denote the elasticity of production with respect to production factors. These are estimated using the semi-parametric technique proposed by Levinsohn and Petrin (2003) based on a Cobb-Douglas production function.

## 4. Data

Our empirical application is based on the plant or ''factory'' level data for the period 2000-01 to 2005-06, compiled by the Central Statistical Office of India in the Annual Survey of Industries (ASI). The ASI factory frame is classified into 2 sectors: the 'census sector' and the 'sample sector'. The sample sector consists of small plants employing 20 to 99 workers if not

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[6] Different parameters have been used as weights in the existing literature. These are, for instance, share of revenue, output, employment, value added, or costs. Of them, output (or revenue) or employment are used most frequently. Following the traditional literature, we have used 'output' weight in the present study.

[7] The input price index is constructed as the weighted average of fuel price, material price, and other input prices. Fuel price, material price and other input prices are constructed using wholesale prices, implicit deflator of national account statistics and weights from input-output tables. The data sources we use for constructing input price index are: Reserve Bank of India, *Handbook of Monetary Statistics of India* and *Database on Indian Economy*; Central Statistical Organisation, *Input-Output Transaction Table*.

using electricity and 10 to 99 workers if using electricity. The census sector comprises relatively large plants. It covers all units having 100 or more workers and also some significant units which although having less than 100 workers, contribute significantly to the value of output. The composition and number of plants are summarized in Table 1.

**Table 1: Composition of plants by year and sector**

| year | Census | Sample | Total |
|---|---|---|---|
| 2000-2001 | 12,297 | 9,930 | 22,227 |
| 2001-2002 | 14,532 | 10,242 | 24,774 |
| 2002-2003 | 11,264 | 16,341 | 27,605 |
| 2003-2004 | 11,207 | 20,185 | 31,392 |
| 2004-2005 | 14,122 | 12,611 | 26,733 |
| 2005-2006 | 17,826 | 1,748 | 19,574 |
| Total | 81,248 | 71,057 | 152,305 |

Source: ASI plant level; data 2000-01 to 2005-06

We focus only on the census sector (100 or more workers) for the decomposition analysis because the data on census plants is exhaustive. We observed this group consisted of five types of plants by their stage of growth: large incumbents (CS), newly established large plants (EN), small sized plants classified in the sample sector in 2000-01 but expanded and upgraded to qualify for the census sector by 2005-06 (ES), large survivor plants that changed their industrial classification (SS and SO), and plants that stopped functioning (exiting plants or EX). It is instructed to note that the ES category firms are essentially gazelles in Birch's analogy. In all, we define 6 categories of plants for our analysis. Their definition and notations are provided in Table 2.

**Table 2: Plant Status Variables**

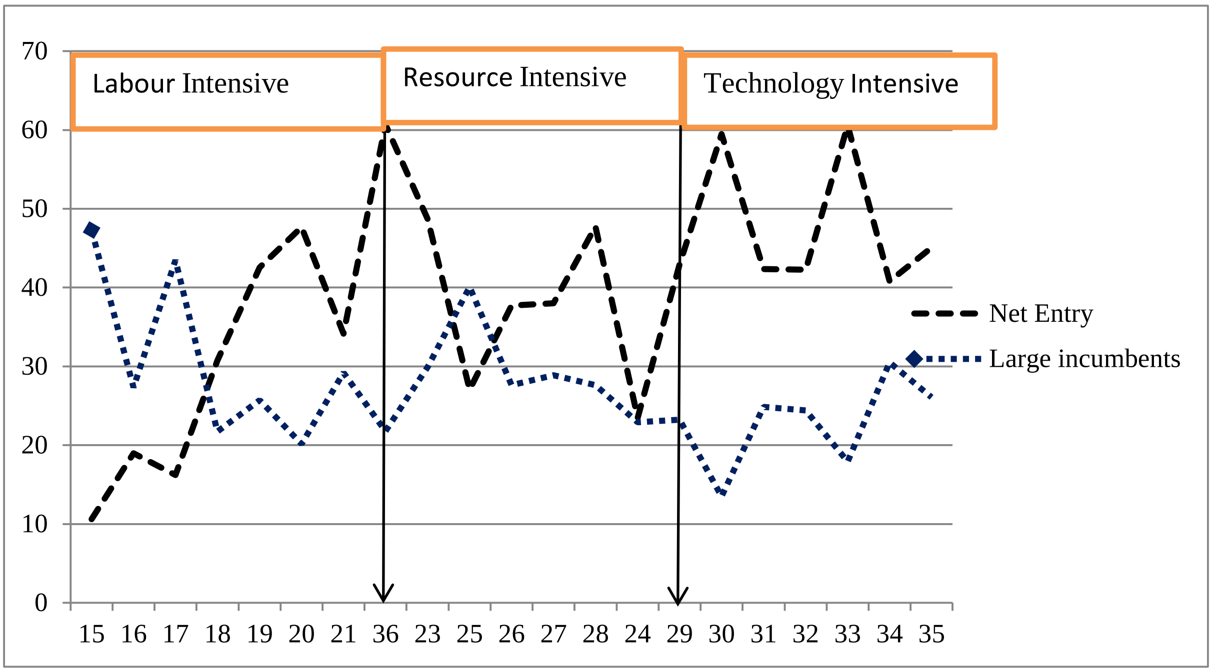
| Status | Notation | Definition |
|---|---|---|
| Large incumbents (Elephants) | CS | Present in both period t and t-k in the census sector |
| Expanding small incumbents (Gazelles) | ES | Present in t in the census sector and t-k in the sample sector |
| New entrants (Fawns) | EN | Present in t in the census sector, absent in t-k |
| Switching in incumbents | SS | Switching-in incumbents that are present in t in the Census sector in industry i, absent in t-k in industry i, but present in t-k in industry j |
| Exitors | EX | Present in t-k in the census sector, drop out in t |
| Switching out incumbents | SO | Present in t-k in industry i, absent in t in industry i, but present in industry j |

Our decomposition analysis thus shows contributions of six groups of plants to aggregate productivity of the manufacturing sector. For analyzing the impact of technological and industrial specifics of the industry on productivity dynamics, we classified the census sector plants into two digit industries based on the Standard ISIC (Rev 3) classification. Under this classification, the industry groups 15-22 and 36 comprise of *labour intensive* industries such as food, textile, apparel, wood, and paper. These are matured and least technology intensive industries. Industries ranging from 23 to 28 are *resource based* and comprise of mineral and metal based industries. These are essentially medium tech industries requiring large investment. Finally, the industry codes 24,29,30,31,32,33,34, and 35 pertain to *technology intensive* industries; they are essentially driven by technology.

## 5. Business dynamism in India: 2000-1 to 2005-06

Table 1 above shows that the number of census sector plants increased across all industries without any exception over this period. Overall, the number of plants in our dataset increased from 12,297 in 2000-01 to 17,826 in 2005-06 i.e. by 45 per cent. Our analysis indicates that of the total plants in 2000-01, a mere 5802 (32.5 percent) plants emerged continuing survivors (CS) in 2005-06; the rest are either newly entering plants (EN) or expanding small incumbents (ES). Figure 1 presents a comprehensive picture of plant dynamics during 2000-01 to 2005-06 at two digit level. A closer examination of the trends in CS firms in Figure 1 reveals that the share of large incumbents has been lower in relatively higher technology and capital intensive industries as compared with that in traditional industries. Overall, 50 to 60 percent of the plants functional in 2000-01 stopped functioning or reduced the scale of their operation such that they were reclassified in the sample sector by 2005-06. Of the 12297 plants operational in 2000-01, only 5982 (48.6 percent) survived by 2005-06 while the rest 6315 (over 51.4 percent) exited. The distribution of these plants is fairly uniform across industries. However, some of the traditional industries such as tobacco, apparel, leather and wood industries witnessed a rather high rate of firms' exit ranging from 60 to 70 percent. On the other hand, technology intensive electronics machinery, instruments, motor vehicle and transport equipment industries had an exit rate ranging between 50 to 60 percent. Petroleum and coke, chemicals and transport (including auto) industries have experienced the lowest exit rates but it also varied between 40 to 50 percent. The destruction of plants was more than offset by new entrants resulting in a restructuring process. This is manifested in the patterns of net entry. Net entry rates have been positive in all the industries at two digit level. Further, the average entry rate was as high as 45% for technology driven industries against 29% for traditional industries. Resource intensive industries lay between the two at 40%. Apparently, the creative destruction process (net entry) accelerates gradually as we move from the traditional to technology intensive industries (Figure 1).

**Figure 1: Plant dynamics in Indian manufacturing during 2000-2006 (%)**




| | Survival rate of large incumbents (1) | Entry rate (2) | Expansion rate of small fast growing plants (3) | Switching-in rate (4) | Exit rate (5) | Switching-rate (6) |
|---|---|---|---|---|---|---|
| Labour Intensive | 36.5 | 21.0 | 42.0 | 0.5 | 39.1 | 0.6 |
| Resource Intensive | 27.3 | 27.2 | 44.4 | 1.1 | 32.8 | 1.1 |
| Tech-intensive | 29.8 | 19.6 | 48.8 | 1.8 | 31.1 | 1.6 |

Note: (1): The ratio of survivors to total plants in 2005-06, (2): The ratio of new entrants to total plans;(3): Fast expanding small plants to total plants; (4):The ratio of switching-in to total plants; (5) and (6): The ratio of exiting and switching-out plants to total plants

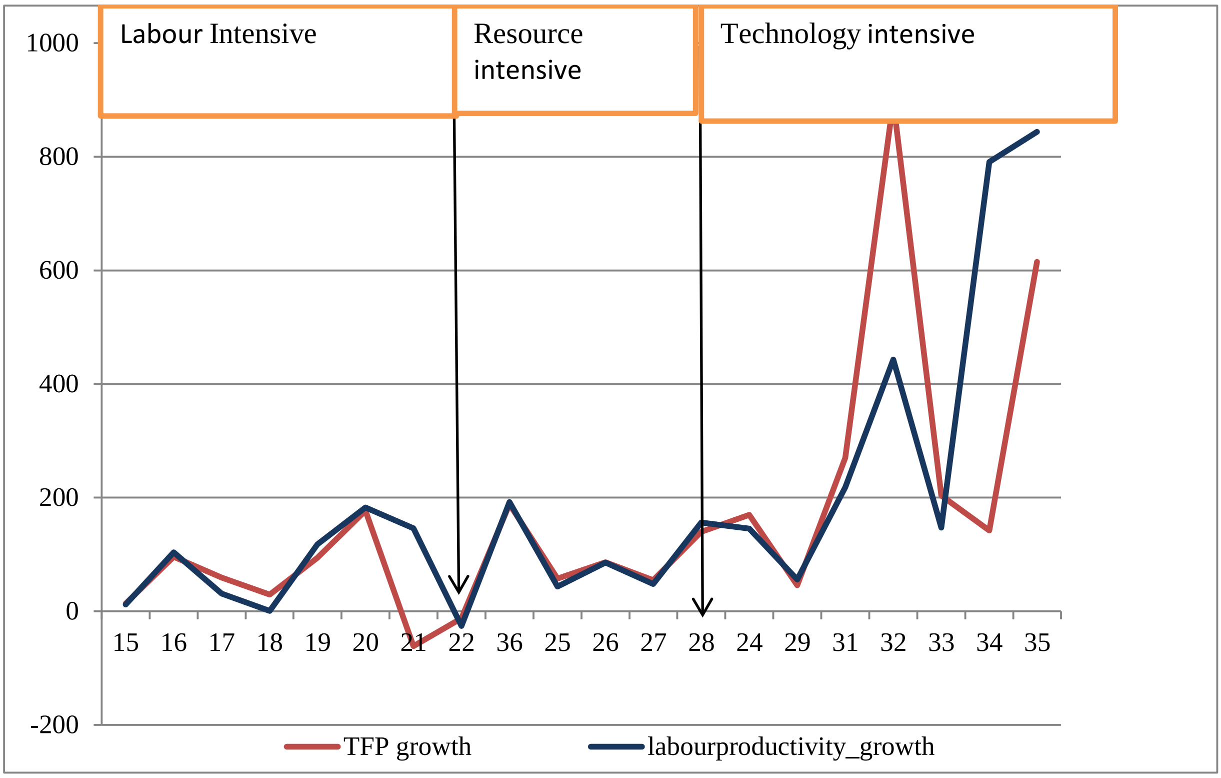
The upshot is that significant business dynamics have been taking place in the economy across all sectors at the plant level. As a result of which the manufacturing sector has undergone tremendous transformation during this period. The change is effected in all industries. But the process of creative destruction seems to be rather intense in modern sectors which are technology and capital intensive. On the other hand, some of the traditional industries such as wood and leather also seem to have undergone significant dynamics at the plant level. A pertinent question is how different plants broken down by stage of growth influenced productivity growth at the macro level.

## 6. Business dynamics and productivity growth

*Productivity growth*

Figure 2 presents the labour and total factor productivity growth rates across two digit level industries in Indian manufacturing over the period from 2000-01 to 2005-06. It shows that productivity has increased across almost all sectors over this period with publishing and printing, and petroleum and coke being the only two exceptions. As expected, there is a remarkable variation or dispersion in the aggregate productivity growth across industries. The cross industry differences in productivity stem essentially from a different combination of skills required in them, the ratio of capital to labour, business dynamics, technological progress, and exposure to international trade. Our data indicates that typically, high-tech industries have experienced relatively higher rates of productivity growth than their low (labour intensive) - and medium (resource intensive)-tech counterparts irrespective of the measure. The strongest productivity growth has come about in the office computing machinery industry. Productivity in this sector grew over 34 times over this period and could not be shown in the figure due to scale issues. Further, it may be seen that the patterns of labour and total factor productivity growth are quite consistent. Interestingly, labour productivity has grown a little faster than TFP in the labour intensive sector. Apparently, there has been downsizing of employment or capital deepening in this sector which improves its performance. In tech intensive sectors, on the other hand, TFP growth has typically outpaced LP growth with the only exception of the automobile and other transport sectors. The latter have been the fastest growing sectors in the economy experiencing rapid expansion in physical investment. Capital deepening appears to be the major factor underlying strong performance in labour productivity relative to TFP growth in these sectors.

**Figure 2: labour productivity and TFP growth across two digit level industries: 2000-01 to 2005-06**




*Decomposition of aggregate productivity growth*

Table 3 presents the decomposition results for Indian manufacturing based on the FHK, GR and DOP methodologies. The top panel in the table is based on the TFP measure, and the bottom one is based on the labour productivity measure. As expected, the results are at variance across the productivity measure and methodology used. Typically, however, the bulk of productivity growth of the census sector in Indian manufacturing over 2001-06 is accounted for by large incumbents. This group of firms can explain up to 82% of the overall growth in productivity depending upon the measure and methodology. Their productivity contributions are more prominent for TFP than LP indicating that much of the productivity growth of incumbents was driven by improved efficiency in the use of resources and technological changes (Disney et al 2003). Our results that the majority of economic growth comes from incumbents (or elephants) are in tune with Acs et al (2008) and Brown et al.

(2014) in the HGF literature. Notably, this finding is rather common in productivity decomposition analyses across the developed and developing countries (see Aggarwal and Sato, 2011; Kocsis et al, 2009; UNIDO, 2009 for literature review). The strong performance of incumbents is explained by their tangible and intangible resource base in terms of wide human capital base, learning, dynamic capabilities, and resources for research and development. Another reason that underlies their superior performance is a constant threat of entry facing them. They have to adopt the escape entry route to survive the threat. They enjoy the relative advantages of size and experience and hence manage to out-compete other groups. Our findings of the contribution of fast growing small incumbents (gazelles) are somewhat confusing. While these plants explain 61% to 71% of the aggregate TFP growth, their labour productivity effects remain rather small. Is it that they compete essentially on the basis of technology and efficient use of resources? To answer this question we combine these results with the productivity contributions of the exiting firms which are also quite at variance across productivity measures. It may be seen that the plants that exit have higher than the industry average TFP but they are essentially labour inefficient. Could it be that the plants that exit are characterized by old capital? Jovanovic and Tse (2006: 3) provide evidence that 'inefficient producers may decide to operate in an industry until they reach the optimal date of their capital replacement. They tend to exit the industry when their capital comes up for replacement because they may not be able to finance the new plant and equipment'. This introduces upward bias in their TFP calculations because they end up with little expansion in capital. In our case, these may thus be inefficient firms with old capital. Coming back to the contribution of small incumbents to productivity, it could be that the exceptional TFP performance combined with low labour productivity of small fast expanding firms in this sector has essentially been due to their not expanding the capital base. New entrants are also found to have a little impact. These results are consistent with Jovanovic (1982). Finally, evidence of industrial structuring from low to high productivity firms is not robust. The results from DOP methodology attribute most productivity growth to restructuring. This could be because, as mentioned above, the DOP approach has drawbacks with regard to productivity allocation within and between established firms.

Overall, most of the changes in aggregate productivity come from the productivity growth of large incumbents. This means that the large incumbents in particular large and matured ones are more likely to reach the HIGF status with productivity improvements (Du and Timouri, 2015). Aggregate figures however mask the sectoral variations.

**Table 3: Decomposition of TFP and LP growth over 2000-1 to 2005-06 (%)**

| | CS | RE | EN | ES | SS | EX | SO | Total |
|---|---|---|---|---|---|---|---|---|
| | Total Factor Productivity | | | | | | | |
| FHK | 82.2 | -12.1 | 4.1 | 73.0 | -8.6 | -38.0 | -0.6 | 100 |
| GR | 81.1 | -5.4 | 1.0 | 61.6 | -11.7 | -26.9 | 0.3 | 100 |
| DP | 29.4 | 69.9 | 1.1 | 61.9 | -11.7 | -49.2 | -1.4 | 100 |
| | Labour Productivity | | | | | | | |
| FHK | 57.9 | 20.7 | 1.5 | 14.1 | 8.1 | 1.7 | 0.6 | 100 |
| GR | 69.5 | 15.0 | -1.7 | 2.7 | 5.0 | 9.2 | 0.2 | 100 |
| DOP | 4.7 | 116.2 | -5.9 | -12.8 | 0.8 | -2.3 | -0.7 | 100 |

Source: Computed by authors based on the ASI Plant level data

*Decomposition by subsector*

Tables 4-6 present industry-wise decomposition results based on the DOP, FHK and GR methodologies across 21 two-digit level industries over 2000-01 to 2005-06. We provide only the weighted averages in the text to avoid an excessive dose of numbers.

*Labour intensive:* Table 4 presents the productivity decomposition results for the labour-intensive sector. We find that the homogenous characteristics of the industry produce results which are quite similar across productivity measures and methodologies. An important finding is that the fast expanding small incumbents (or gazelles) are the driving force of productivity growth in this sector. Unlike at the aggregate level, the contribution of large incumbents to productivity growth in particular TFP remains rather small in the labour intensive sector. This is in contradiction with the predictions of Aghion et al (2009) and Geroski (1995) that incumbents in technologically laggard and matured industries may respond to business dynamics by moving to technology frontiers to counter competition from new/expanding entrants. It may be seen that they do resort to downsizing of employment/capital deepening to improve their labour productivity but their contribution even to LP remains relatively small. Entry of new firms pulls down productivity growth at least in the short period. This holds true, irrespective of the productivity measure and methodology. The exit effects are however ambiguous. But, the plants that contract are necessarily less efficient than the industry average. Finally, there is some evidence of internal restructuring if labour productivity growth is used as a measure of productivity. But firms with greater TFP are not likely to increase their market share.

**Table 4: Weighted average of low tech decompositions: 2000-01 to 2005-06 (%)**

| | CS | RE | EN | ES | SS | EX | SO | Total |
|---|---|---|---|---|---|---|---|---|
| | Total Factor Productivity | | | | | | | |
| FHK | 9.19 | 0.05 | -0.02 | 93.35 | 5.87 | -8.48 | 0.04 | 100 |
| GR | 8.54 | 6.37 | -2.49 | 55.99 | 4.51 | 26.98 | 0.09 | 100 |
| DOP | 6.91 | 13.0 | -0.51 | 146.5 | 4.23 | -70.11 | 0.04 | 100 |
| | Labour Productivity | | | | | | | |
| FHK | 17.3 | 13.4 | 5.50 | 61.10 | 5.79 | -3.32 | 0.26 | 100 |
| GR | 25.7 | 12.6 | -0.03 | 33.38 | 4.82 | 22.67 | 0.83 | 100 |
| DOP | 19.1 | 47.5 | -9.07 | 74.58 | 4.79 | -37.15 | 0.28 | 100 |

Overall, gazelles contribute 80% to 90% of TFP and 40-70% of labour productivity in the labour intensive sector. This means that this group of firms is most likely to be the HIGFs and has the potential of nourishing HGFs.

*Resource intensive:* Contrary to the labour intensive sector, productivity growth in the resource intensive sector is driven essentially by internal dynamics of large incumbents. It may be noted that industries in this sector are essentially heavy and strategic in nature, and had been assigned top priority in the state-led heavy industrialisation-regime adopted by the government of India in 1956. Since then, substantial capacity has been built in these industries in India. Considering the fact that these industries are capital and scale intensive, the incumbent firms continue to build on their competitive advantages to improve their labour and total factor productivity and push aggregate productivity growth up in this sector. Inefficient firms in the liberalised era exited but their effect remains rather small, perhaps due to their small presence. The small incumbents or new entrants (fawns) remained laggard in comparison to the existing matured and well established large incumbents. Clearly, given the sector specifics, the 'high growth incumbents' are more likely to form HIGF in this sector and need special focus from the macroeconomic growth perspective. Gazelles are not likely to add substantially to the growth potential of the economy.

**Table 5: Weighted average of Resource intensive sector decompositions: 2000-01 to 2005-06 (%)**

| | Established | Allocative effeiciency | New | Small incumbents | Diversifying large incumbents | Existing firms | Contracting firms | Total |
|---|---|---|---|---|---|---|---|---|
| | **Total Factor Productivity** | | | | | | | |
| FHK | 79.07 | -0.16 | 4.57 | 14.99 | -0.24 | -0.24 | 2.00 | 100 |
| GR | 81.61 | 4.24 | 0.30 | 1.39 | -0.79 | 8.81 | 4.43 | 100 |
| DOP | 40.02 | 87.16 | -6.58 | -20.96 | -1.70 | 0.06 | 2.01 | 100 |
| | **Labour Productivity** | | | | | | | |
| FHK | 97.26 | -9.90 | 0.11 | 1.25 | 13.35 | -2.19 | 0.12 | 100 |
| GR | 91.33 | 7.75 | -0.37 | -0.52 | 1.57 | 0.03 | 0.22 | 100 |
| DOP | 23.48 | 98.56 | -1.10 | -3.26 | -14.39 | -3.32 | 0.03 | 100 |

*Technology driven sector:* This sector presents a classical case in which irrespective of the methodology and measure, fast growing small incumbents (or gazelles) emerge as the major contributors to productivity growth and their share remains almost the same irrespective of the productivity measure. According to the GR methodology, their contributions are supplemented by the exit of inefficient firms. The contribution of large incumbents to macroeconomic productivity remains small throughout and new entrants appear to pull productivity down (except in FHK). Thus the gazelles' role in enhancing the growth potential of the economy appears to be most unambiguous in the high tech sectors and these is most likely to be the HIGFs in the economy which needs to be targeted with the utmost urgency. It may be noted that the business dynamics are also found to be the most prominent in this sector.

**Table 6: Weighted average of technology intensive sector decompositions: 2000-01 to 2005-06 (%)**

| | CS | RE | EN | ES | SS | EX | SO | Total |
|---|---|---|---|---|---|---|---|---|
| | **Total factor productivity** | | | | | | | |
| FHK | 13.14 | -3.13 | 2.8 | 85.98 | 0.05 | 1.06 | 0.1 | 100 |
| GR | 12.22 | 5.23 | -8.68 | 59.13 | -0.64 | 31.02 | 1.73 | 100 |
| DOP | 7.27 | 12.61 | -0.4 | 77.52 | -0.13 | 2.93 | 0.2 | 100 |
| | **Labour productivity** | | | | | | | |
| FHK | 15.6 | 1.18 | 2.93 | 79.68 | 0.16 | 0.53 | -0.09 | 100 |
| GR | 16.12 | 7.79 | -8.06 | 54.63 | -0.63 | 28.84 | 1.32 | 100 |
| DOP | 6.91 | 22.8 | -0.21 | 69.19 | -0.45 | 1.79 | -0.03 | 100 |

## 7. Conclusion

Over the past two decades, considerable interest has grown in HGFs. Initially, it emanated from the policy perspective due to the major role that these firms are shown to play in job creation. Since 2010, there has been a rapid proliferation in research studies on HGFs. However, the concept of HGFs still remains controversial. Much of this controversy can be attributed to the ambiguity that surrounds the concept of HGFs. One of the most controversial issues is size and age of these firms. There have been several empirical attempts to establish whether these are young, small or matured firms. But findings are inconclusive. This is not unexpected as ‘high growth’ is not a sustainable phenomenon. Rather, it is a temporary phase or an episode which can come about in any firm. We therefore propose a concept of high impact group of firms and explain it within the framework of overall business and macroeconomic- productivity dynamics. While doing so, we attempt to identify it by analysing the contribution of firms to macroeconomic productivity growth by stage of their growth. Our empirical study reveals that much depends on the industry/sector specific characteristics. The business dynamism is most strongly linked with firm and productivity dynamism in the technology driven sector. Even if new firms (fawns) remain inconsequential in productivity growth, fast expanding small firms or gazelles make a substantial contribution to macroeconomic productivity growth and hence are the HIGFs. In the labour intensive sector also gazelles display significant contribution to productivity. They are supported by large incumbent also in pushing macroeconomic productivity growth. In the scale intensive heavy industries however large incumbents (or elephants) are likely to account for a majority of productivity growth. Thus new and small firms are not likely to contribute significantly to macro productivity dynamics in any subsector. In traditional and high tech sectors, therefore, rapidly growing small firms should be the major targets for policy makers while in scale intensive industries, established large firms need to be promoted to grow faster. Productivity contribution of fawns remains rather small. It is well documented in the literature also (Baily et al. 1992; Bahk and Gort, 1993; Jovanovic and Tse, 2006). Clearly, the policy makers have to reorient their attention to the small number of high-potential firms in the small sector in both labour-intensive and technology-intensive sectors in particular in the latter. However, in the resource intensive sectors large matured firms need to be supported by suitably crafted initiatives.

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