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Michael J. Ferrantino\*  
U.S. International Trade Commission

Megha Mukim  
World Bank

Alison Pearson  
Brandeis University

Nathanael Snow\*  
George Mason University and U.S. International Trade Commission

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Address correspondence to:  
Office of Economics  
U.S. International Trade Commission  
Washington, DC 20436 USA

# Gazelles and Gazillas in China and India

**Michael J. Ferrantino<sup>1</sup>**

*U.S. International Trade Commission*

**Megha Mukim**

*World Bank*

**Alison Pearson**

*Brandeis University*

**Nathanael Snow**

*George Mason University and U.S. International Trade Commission*

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## ABSTRACT

In the literature on firm-level data, “gazelles” refer to rapidly-growing firms, which are of interest both because of their disproportionate contribution to employment and as an indicator of entrepreneurship. This paper makes three contributions: (1) It focuses on gazelles in China and India, whereas the current literature uses OECD data; (2) It examines the relationship between gazelles and exporting; (3) It focuses on “gazillas,” very large firms which also grow rapidly, and which may be archetypal of the development of markets in a given country. Gazelles exist in all sectors in both China and India. On the margin, exporters of goods are more likely to be gazelles in both China and India, but many non-exporters are gazelles, suggesting that there are substantial opportunities in selling to the domestic market. In both countries, state-owned enterprises are less likely on average to be gazelles and foreign-owned enterprises are more likely, but there are significant counterexamples. Prominent gazillas in China include both foreign-invested enterprises (e.g. Foxconn), which are export-intensive, and state-owned enterprises (e.g. units of Sinopec), which focus on the domestic market. In India, gazillas are featured in both software and in recently reformed service sectors, such as telecom, where they have been key to the explosive diffusion of mobile phones in the last 20 years.

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## I. Introduction

In the literature on firm-level data, the term “gazelles” refers to rapidly-growing firms. Gazelles are of interest both because of their disproportionate contribution to employment and as an indicator of entrepreneurship. The idea of “gazelles” dates from the work of David Birch (Birch, Haggerty and Parsons 1993, 1994). Birch classified firms into “mice,” small firms that tended to stay small; “elephants,” large firms that did not grow rapidly, and “gazelles,” firms that did grow rapidly and which accounted for a large share of employment or revenue growth. Gazelles are not identical with SMEs, as they include both small firms becoming large and large firms which continue to grow rapidly. A better understanding of the characteristics of gazelles, and the environments in which they thrive or fail to thrive, could lead to new insights on the conditions under which entrepreneurship thrives or fails to thrive, a matter which ought to be of great concern to policymakers.

This paper makes three contributions to the literature on gazelles. First, we focus on gazelles in China and India, using two firm-level datasets available for this purpose. There is little known about the profile of rapidly-growing firms in developing countries. To our knowledge, the literature on gazelles has so far relied on examples drawn from OECD data, and the conclusions from that literature may not generalize. We provide profiles for the two largest developing economies and are able to contrast them to some degree, though differences in coverage in the datasets pose some challenges for comparison.

Second, we examine the relationship between gazelles and exporting. Are exporting firms more likely to be gazelles? Can you be a gazelle without exporting, and if so, how? This perspective complements the extensive literature on exporting and productivity.<sup>2</sup> Rapid growth and productivity are alternate methods of measuring firm success, which have different implications – for example, firms gaining in productivity may shed jobs, whereas rapidly growing firms are more likely to employ new workers. Moreover, measurement of firm growth, whether by revenue, employment, or some other metric, is arguably less sensitive to details of method than is productivity measurement, in particular the measurement of TFP.

Third, we introduce the concept of “gazillas,” very large firms which also grow rapidly. That is, we add to the firm-level bestiary of “mice,” “elephants” and “gazelles” a mythical animal, meant to denote a gazelle the size of Godzilla. Recent examples of gazillas include Apple in the United States, Gazprom in Russia, and Nintendo in Japan. While it has previously been noted that not all gazelles are small<sup>3</sup>, we believe that the largest rapidly-growing firms in an economy may be archetypal of a number of features in the economic environment, and that the stories of gazillas are particularly informative with respect to broad national differences in economic development, as well as yielding insights into large episodes of reform and structural change. Both the Chinese and Indian data disclose the names of individual firms, unlike in most OECD firm-level data where the names are protected by confidentiality. This allows us to

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<sup>2</sup> See Wagner (2007) for a review.

<sup>3</sup> Birch et al. (1995) identified gazelles with initial employment of 100 or more as “Superstars,” while Acs, Parsons and Tracy (2008) identify a group of “super-high-impact firms” with initial employment of 500.

identify the largest high-growth firms and develop narratives about them using open-source information.

Our principal findings are as follows: Gazelles exist in all sectors in both China and India. On the margin, exporters of goods are more likely to be gazelles in both China and India, but many non-exporters are gazelles, suggesting that there are substantial opportunities in selling to the domestic market. In both countries, state-owned enterprises are less likely on average to be gazelles and foreign-owned enterprises are more likely, but there are significant counterexamples. In India, firms affiliated with business groups such as Tata and Reliance are as likely to experience episodes of rapid growth as are foreign-owned enterprises. Prominent gazillas in China include both foreign-invested enterprises (e.g. Foxconn), which are export-intensive, and state-owned enterprises (e.g. units of Sinopec), which focus on the domestic market. In India, gazillas are featured in both software and in recently reformed service sectors, such as telecom, where they have been key to the explosive diffusion of mobile phones in the last 20 years.

The paper begins by briefly discussing gazelles and what is known about them in Section II. Section III briefly describes certain characteristics of the datasets used for China – the so-called “5 Million Renminbi” dataset of the National Bureau of Statistics, and India, the privately generated Prowess dataset of publicly traded enterprises. Section IV lays out the primary stylized facts about Indian and Chinese gazelles – their frequency, contribution to overall growth, profile with respect to age, size, and exporting status, and their sectoral and geographic distribution within Chinese provinces and Indian states and territories. Section V summarizes broad characteristics of the propensity to grow rapidly by means of probit regressions, focusing on ownership type – foreign-owned, state-owned, privately owned and variants. Section VI discusses the concept of “gazillas,” identifying the principal examples of very large rapidly-growing firms in China and India and drawing out two of many possible narratives – one about telecommunications reform in India, and another about the role of state-owned enterprises in China. The final section concludes by discussing some of the many open research questions posed by what we have learned so far.

## II. Gazelles – what do we know already?

Gazelles are rapidly-growing firms, as measured by sales, employment, output, market share or some other metric. There is no standard definition of gazelles. Henrekson and Johansson (2010), in a survey of studies done through 2009, look at some of the alternatives. Birch et al. (1995) define gazelles as establishments with at least 20% sales growth over an interval, starting from a base-year revenue of at least \$100,000. This growth rate corresponds approximately to a doubling of revenues every four years. An alternative is to sort firms by growth rates and declare the top x% to be gazelles. This alternative does not allow for time variation in the percentage of gazelles. Other alternatives supplement growth rate with age (only young firms can be gazelles) or employment impact (an index number taking into account firm size and the absolute number of jobs created, as in Acs, Parsons, and Tracy (2008)). We define gazelles as firms that double their real sales during a four-year period.

The studies reviewed by Henrekson and Johansson (2010) all use data from OECD countries, including the United States, United Kingdom, Canada, Germany, France, Italy, the Netherlands, Spain, Sweden, or sub-regions thereof. A number of stylized facts appear frequently across studies:

- ***Gazelles generate a large share of net jobs, or sales,*** or whichever metric is being considered. This is of course in part an artifact of the way gazelles are defined. However, the skewness of the contribution to growth among firms is often striking; for example, Acs, Parsons and Tracy (2008) report that “high-impact firms,” accounting for 2 to 3 percent of the total, account for almost all new jobs in the economy. This is particularly notable because the firms are not chosen for size, but include many small firms. More than one study finds that gazelles account for more than 100 percent of net job generation economy-wide. This is possible because net job creation among “mice” (small firms that stay small) and/or “elephants” (stagnating large firms) can be negative.

Earlier research by Birch (1979) found that small and medium-sized enterprises (SMEs) generated a disproportionate number of new jobs. This finding has been widely publicized, and frequently repeated in American political discourse. Most U.S. presidents have at some time or other declared that SMEs are especially good at generating jobs, and that the government ought to look out for their interests, either by active support or by getting out of their way depending on the political philosophy applied. However, any unique link between SMEs and job creation turns out to be fragile, as has frequently been pointed out (Brown et al. 1990), Davis et al. 1996, Haltiwanger and Krizan 1999, Neumark et al. 2011, Haltiwanger et al. 2010). There are several reasons for the broken link. First, many SMEs stay small and do not generate a lot of jobs. Second, many SMEs exit the market, thus destroying jobs on net. This explains the redirection of the search for a link between “special firms” and job growth from SMEs to gazelles.

- ***Gazelles tend to be younger on average than other firms.*** The age of firms tends to be correlated with firm size; many SMEs are young or new firms, while larger firms are older almost of necessity, since it takes time to grow. Haltiwanger et al. (2010) demonstrate that for U.S. firms, there is no systematic relationship between firm size and growth once age is controlled for.
- ***Small firms are disproportionately represented among gazelles,*** but ***some of them are also large.*** As noted earlier, both Birch et al. (1995) and Acs, Parsons and Tracy (2008) identify the presence of gazelles in the largest size class they consider – firms with 100+ employees and 500+ employees respectively. Our focus on “gazillas” is a further development of this feature of the data, facilitated by the fact that individual firm names are disclosed in both the Chinese and Indian data.
- ***Gazelles appear in all sectors, though they are more prevalent in some sectors than others.*** For studies using OECD manufacturing data, there does not appear to be a marked trend for electronics or other stereotypically “high tech” sectors to contain a higher proportion of gazelles than other manufacturing sectors. For studies including firms from the entire economy, there

may be a propensity for service firms to be over-represented in the population of gazelles relative to manufacturing firms.

A relatively less explored issue noted by Henrekson and Johansson is the question of whether rapid growth is “organic” or “acquired.” Organic growth involves more sales and employment within the same firm or establishment, while acquired growth proceeds by mergers and acquisition. It is thought that organic growth may be more likely to promote employment, while acquired growth may be more characteristic of mature industries and more likely to promote productivity. This issue arises in an indirect form in our study – some of our Indian firms are parts of larger “industrial groups,” whose growth we do not measure directly. Some of our Chinese gazelles turn out on inspection to be pieces of larger enterprises, for example subsidiaries of Sinopec or PetroChina. Foreign-owned gazelles in India and China are of course pieces of larger companies headquartered in another country. In each case we measure the growth of the part rather than the whole.

### III. Data

For our purposes, gazelles are defined as firms that double their real (deflated) sales during any four-year window in the available data. That is, for the period 2002-2006, if  $(sales_{2006}/sales_{2002}) > 2$  or more, an enterprise is considered to be a gazelle for that period. Over longer periods, any given firm is likely to have episodes when it is a gazelle and episodes when it is not.

Indian firm level data was obtained from the Prowess database collected by the Centre for Monitoring the Indian Economy, and is drawn from company balance sheets and income statements. Alfaro and Chari (2009) describe the database for the period 1988-2005, and detail strengths and limitations of the database. For that period, about one-third of the firms in Prowess were publicly listed in financial markets, and the sample accounted for more than 70 percent of industrial output, 75 percent of corporate taxes, and 95 percent of excise taxes collected by the Government of India. This gives a rough idea of the coverage in Prowess – our sample may vary somewhat since it includes additional firms added from 2006-2008. Prowess is intended to cover the organized sector, firms for which financial reports are available, and does not include the informal sector.

Chinese firm level data was originally collected by the National Bureau of Statistics for their Annual Survey of Industrial Enterprises. The survey includes all corporate industrial enterprises with annual revenue of at least 5 million RMB from their principal business activity. A corporate industrial enterprise is defined as a firm that is established legally with its own name, possesses assets and assumes liabilities independently, and is financially independent. An enterprise is considered industrial if it engages in the extraction of natural resources, or processing, manufacturing, or repair of mineral and agricultural products. Thus enterprises that operate in most service sectors are excluded.

The Chinese and Indian data will be used for comparison throughout the paper, so a few key differences in the way they were created should be noted. The Indian dataset includes firms in all sectors, including various services, and the Chinese dataset is restricted to industrial sectors as defined above. The Indian dataset includes data from 1989 to 2008, a longer time period than is available for China, which is only usable from 1999-2008. While China has fewer years available, it has many more firms per year than

India. There are 596,249 firms included in the Chinese dataset. Because we are defining gazelles by using four year periods, we need revenue for the first and fourth year in order to identify a firm as a gazelle. When this restriction is taken into account, the Chinese dataset is able to use 89,585 firms at minimum for a period and 196,095 firms at maximum. India, by contrast, has only 21,270 firms in total, with 1,358 firms as the minimum in a period and 4,713 firms as the maximum.

For the purpose of analyzing the datasets, the revenues of the firms were converted using industry specific deflators to constant 2000 local currency. In order to compare the sizes of the firms, these revenues were converted to constant 2000 USD, using the contemporary exchange rate. All other analysis was done in constant 2000 local currency.

Figure 1 compares the distribution of the size of firms in terms of revenue for the Indian and Chinese data.<sup>4</sup> As seen, the Chinese dataset includes a higher proportion of smaller firms (\$1-\$5 million) than the Indian dataset. The Indian dataset still has some firms that are smaller (\$1-\$5 million), but also includes more medium sized firms (\$10-\$25 million). This difference in distribution is probably due to the way firms were selected to be in the datasets. The Chinese dataset has a cutoff on the low end, thereby it includes many small firms (Five million constant 2000 RMB is about 600,000 constant 2000 USD.). The Indian dataset, on the other hand, was selected from publically listed firms, which are probably larger and more established than the average firm in India, causing the dataset to have a greater proportion of medium sized firms. Over time, the distribution of firm sizes in China shifts slowly to the right, indicating growth of firms at all sizes, while the left tail of the distribution for India becomes substantially thicker over time, indicating that the firms added to Prowess over time are likely to be smaller than the ones added earlier.

#### IV. Stylized facts

##### a. Prevalence of Gazelles

Figure 2 illustrates the frequency of gazelles in the Chinese data, illustrating both how the frequency changes over time and comparing it to Chinese export data as a macroeconomic benchmark. In Figure 2a, the share of gazelles in each four-year window rises from 10.4 percent in 1999-2002 to 22.1 percent in 2001-2004, and then declines to 13.1 percent in 2004-2007.<sup>5</sup> We do not use the 2008 data because of completeness issues. An immediate question is whether this inverted-U pattern is an artifact of the construction of the dataset, or whether it reflects some underlying pattern such as acceleration and deceleration in growth of the Chinese manufacturing sector. In Figure 2a, we use growth rates in Chinese (nominal) merchandise exports as a rough proxy for the growth of manufacturing. Both the 5

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<sup>4</sup> Note that the buckets chosen here are not in equal intervals, but instead chosen so that the distributions would be easy to see.

<sup>5</sup> Due to changes in procedures at China's National Bureau of Statistics, there are substantially more firms in the database from 2004 onwards. The number of firms observable in each window (i.e. for which revenues are available in the first year and the last year) increases steadily from 75,421 for 1999-2003 to 123,157 for 2003-2007, and then sharply to 196,095 in 2004-2008. Since this discontinuity only affects the last point in Figure 2, we think it most likely that the inverted U-shape for the presence of gazelles does in fact represent a macroeconomic phenomenon rather than an artifact of data collection.

Million RMB dataset and Chinese exports are dominated by manufacturing. These data show a similar pattern as the gazelle data, with the peak one year later (2002-2005 for trade). This suggests that the time variation in the propensity of firms to “gazelle” is in large part macroeconomic, and that period dummies are thus appropriate when we do regressions.

Figure 3 shows a similar pattern with respect to Indian gazelles. Broadly, these data show that gazelles are rare in the pre-reform period, but become much more common thereafter. The reform period is conventionally dated as beginning in July 1991, shortly after the onset of the government of Prime Minister P.V. Narasimha Rao and Finance Minister Manmohan Singh. The first three four-year windows thus are at least partly influenced by the pre-reform period, and the share of gazelles in the Prowess dataset ranges from 2 to 5 percent. After the onset of reform, the propensity to gazelle accelerates sharply – 21.1 percent of firms in the 1993-1996 window are gazelles. Gazelles become less common in the late 1990s, dropping to an 8.4 percent share in the 1996-1999 window. Thereafter, rapidly growing firms become more prominent, with the share steadily increasing to 27.6 percent in 2005-2008. Since new firms enter the Prowess dataset at a rapid rate year-by-year, either because they are true entrants or because Prowess obtains financial data on them, the number of recorded gazelles increases even more dramatically, from 301 in 1996-199 to 1,661 in 2005-2008. The figure also shows that the share of gazelles moves with GDP growth (the correlation coefficient of the two series is .85) and that the share of gazelles is more volatile than GDP growth (the coefficient of variation of the former is .55, while that of the latter is .27).

We have six windows in common for China and India, the ones spanning 1999-2002 to 2004-2007. For that period of time, the average share of gazelles in the respective datasets is 15.3 percent for China and 16.9 percent for India. These percentages are fairly similar. The differences between the datasets should be borne in mind here – the data for India includes services while China mostly does not. The China data includes more small firms which may have a better chance of gazelling. More notable is that at the end of 2007 (and through 2008) the share of rapidly growing firms was rising in India but declining in China.

#### b. Contribution of Gazelles to overall growth

Next, we ask how skewed is the distribution of revenue growth for the firms in each of our samples. We know by definition that gazelles account for a disproportionate share of revenue growth, and that in the OECD studies a small firms can account for a very high share of revenue growth or employment growth. Figure 4 shows the impact of gazelles in the China sample. The left panel contrasts the real revenue growth in each window for gazelles and non-gazelles. To be a gazelle, one has only to have 100 percent revenue growth in a window, but in aggregate the group of gazelles in each window grows by 218 to 290 percent, that is, they triple or quadruple their revenue. The right panel shows the share of revenue growth in each window which is accounted for by non-gazelles. In general, 10 to 20 percent of the firms in the China sample account for 30 to 70 percent of the revenue growth, but this skewness varies substantially over time. In 2001-2004, when manufacturing was growing most rapidly, 22.1 percent of firms accounted for 72.3 percent of real revenue growth. By 2004-2007, the revenue growth of both gazelles and non-gazelles has risen, and the relative importance of gazelles has become less



pronounced, with 13.1 percent of firms accounting for 31.5 percent of revenue growth. The acceleration of revenue growth in 2004-2007 is in tension with the deceleration in export growth shown above, suggesting that many of these firms are selling to the domestic market. We will explore this later.

In India, the difference in performance between gazelles and non-gazelles is much more striking, as illustrated in Figure 5. Over the 17 available windows, the aggregate real revenue growth of gazelles fluctuates in a range from 178 percent to 251 percent. The big difference is the very sluggish performance of non-gazelles. For the windows from 1989-1992 through 1992-1995, which largely include the pre-reform period, aggregate real revenue growth of the firms in Prowess is negative. There is also negative growth in the windows 1995-1998 through 1997-2000. That is, there are a small number of gazelles in the earlier periods, and though their performance is outstanding, they are not enough to create aggregate growth. Since aggregate sales growth in these periods is negative, the share of gazelles in total sales growth is undefined. Not until the window 1998-2001 is aggregate sales growth in Prowess significantly positive. During the two windows spanning 1999-2003, Indian gazelles, (approximately 11 percent of the total firms in Prowess, account for more than 100 percent of sales growth, because the “elephants” and “mice” in the rest of the Prowess dataset are contracting. By 2002-2005, the growth of non-gazelles in India is on a steady upward trend, reducing the relative contribution of gazelles. Thus, in the last window (2005-2008), 27.6 percent of the firms are gazelles, and they contribute only 44.1 percent of the revenue growth.

### c. Gazelling, Exporting Status, and Age

In China, exporters are more likely to be gazelles, but many gazelles are not exporters. The stylized facts are presented in Table 1. The analysis for China is constrained to four of the six windows, because export data is missing for 2006 and 2007. Over the period 2002-2005, 37.9 percent of exporters have undergone an episode of rapid growth, as compared to 29.3 percent of the non-exporters. This is also true on a year-by-year basis, though the difference between exporters and non-exporters is generally only about three percentage points (e.g, 19.4 percent vs. 16.2 percent in 2002-2005). So while exporting is associated with rapid growth on average, it is not necessary for rapid growth. In any given window, non-exporting gazelles outnumber exporting gazelles by 2 to 1 or more (e.g. in 2002-2005 there were 11,699 non-exporting gazelles and 6,137 exporting gazelles). This result is striking since most of the firms in the Chinese data produce merchandise that in principle could be exported (the data do not encompass service exports).

In India, non-exporting firms are more likely to be gazelles than exporting firms. Non-exporting firms are twice as likely to be gazelles as exporting firms (Table 2). It is important to note that the Prowess dataset contains a lot of service firms, but a similar tabulation for manufacturing firms only (not shown) shows that there is no significant difference between exporting and non-exporting firms in their propensity to grow rapidly.

The OECD literature tells us that younger firms are more likely to grow rapidly. This also is true for China and India. We look at China and India differently (NB this is work-in-progress). For China, we consider the age of the firm at the time of the first year of the window. Since there are only six windows, age is a partial proxy for the historical time the firm was founded. For example, 10-year-old firms in our sample were founded in the period from 1989-1994, during China's "third generation" of Communist Party leadership following Tiananmen Square. For India, where we have a longer time period, we sort out the firms according to the year they were founded, using broad time periods evocative of India's history. We begin by doing cross-tabulations of gazelle status, exporting status, and age. This will help to motivate the probit regressions presented later on the likelihood of being a gazelle. It also helps to illustrate the point that many firms grow rapidly without exporting, even though they produce an exportable good.

In this section, we categorize a firm as a gazelle if it has undergone one or more episodes of doubling firm growth in any period. Similarly, a firm is classified as an exporter if it has ever been observed exporting. Firms may start and stop growing fast. The period of gazelling need not be the period of exporting.

Table 3 shows the distribution of Chinese firms by age, exporting, and gazelle status. The median age of a firm in the Chinese dataset is about 8 years, and the median age for gazelles is about 6 years. The prevalence of gazelles is significantly higher for firms 25 years and younger. Among firms 10 years old or less, 17.7 percent have undergone at least one episode of gazelling, as opposed to about 6 percent for firms 26 years old or more. More than half of the gazelles do not export. As an illustration, in 2004-2007 there were 7,605 gazelles that exported and 18,035 gazelles that did not export, so that 70 percent of all rapidly-growing firms sell to the domestic market. This is striking since the firms are mostly goods-producing goods firms that could export in principle, and China is known as an export powerhouse. A further examination of Table 6 suggests that for firms of a similar age, gazelles are more likely to export than non-gazelles, but not by much.

In India, the association of newer firms with gazelling holds for the post-Independence period (Table 4). 27.5 percent of the firms established during the license Raj era (1948-1990) are gazelles, compared to 59.7 percent in the immediate post-liberalization era (1991-2000) and 63.8 percent in the globalized era. Notably, firms in the pre-Independence era are more likely to have been gazelles than firms established in the immediate post-Independence area. Since our data are from 1989 onward, this suggests that firms established under British rule were more likely to be successful in finding growth opportunities from reform than firms that were founded in the days of Jawaharlal Nehru and Indira Gandhi. As can be seen, the requirement of a clear exporting/non-exporting status shrinks the sample size dramatically. drop in the share of exporters reported most likely reflects an increase in the number of services firms.

#### d. Sectoral profile

To facilitate comparison of the China and India datasets on a sectoral basis we concord both of them to 2-digit ISIC, and then aggregate the sectors into bundles. This primarily involves concurring the Chinese industry categories to ISIC since the Indian ones are already ISIC-based. We develop categories suitable

for China, which is mostly manufacturing, and then apply the same categories to India, labeling the additional sectors available for India as “Services.” Then we disaggregate services for India.

Figure 5 shows the intensity of gazelles by broad industry and time period. The peak observed in the aggregate for 2001-2004 applies to all the sectors. There is significant variation across the sectors in the likelihood that any individual firm is a gazelle, which is fairly consistent across time periods. Electronics and related equipment (ISIC 30-32) is in first place, but not by as much as one would think given its prominence in exports. Measuring at the peak, where the dispersion is widest, the share of electronics firms which are gazelles is equal to that for vehicles, parts, and repair, at about 31 percent. The auto industry in China is mostly domestically oriented. The likelihood that firms in these sectors gazelle is almost twice that for chemicals, which is closely tied to the petrochemical industry in China, and much higher than for utilities and recycling.

In order to examine the relationship between gazelling and exporting further, we tabulate the propensity to export by 2-digit sector. Note that because data on exporting is unavailable for some years, we can only calculate this share for four of the six windows. We present the results of this tabulation by ISIC Rev. 3 in Table 5. Using the share of gazelles that have ever been observed to export, we find that over 65 percent of gazelles export in furniture, apparel, telecom equipment, and computer and office equipment. At the other extreme, almost no gazelles in utilities (electricity, gas, steam and hot water supply) export, as is to be expected. However, only 20-25 percent of gazelles export in basic metals and non-metallic mineral products, only 15-20 percent in paper and publishing, only 11 percent in petroleum refining and coke, and only about 5 percent in coal and metal ores. Though we have not yet cross-tabulated these by ownership type, it is likely that the exporting and non-exporting gazelles split strongly, with the exporters being predominantly foreign-invested enterprises (FIEs) and the non-exporters being state-owned enterprises (SOEs). It may also be the case that the exporting gazelles are more likely to be in the eastern coastal provinces while the non-exporting gazelles are more likely to be out west.

Such a pattern, if confirmed, is strongly suggestive of two paths to success in China – one for export-oriented FIEs and another for domestically-oriented SOEs. This may have further implications for political economy, and the tensions between market-oriented Westernizing tendencies and planning-oriented tendencies which abound in Chinese politics.

Turning to India, we begin by looking at a sectoral distribution comparable to that for China (Figure 6), with the addition of services as marked by the thick blue line. As in China, the overall share of gazelles in all sectors moves up and down together with macroeconomic conditions. Given the length of the time period, there is no permanent sorting among the manufacturing sectors, but rather a succession. Transport equipment firms flourish in the early 1990s immediately after reform, utilities firms around 2000, and extractive industries and electronics most recently. The secular trend of services to be more successful in gazelling than most of the manufacturing sectors is most notable, becoming pronounced after 2005. In 2005-2008, 40 percent of service firms in Prowess are gazelles, as compared to 12 percent in transport and 13 percent in chemicals. On top of the fact that service firms are more likely to be gazelles, a lot more of the firms in Prowess are service firms over time (Figure 7). With the share of

service firms in Prowess growing from 15 percent to 33 percent over the observable period, and the likelihood of a service firm being a gazelle increasing from 16 percent to 40 percent, the overall share of services in the population of gazelles increases from 18 percent to 51 percent.

#### e. Geographic profile

In looking at geography, we classify firms as a gazelle according to whether they have ever undergone a period of doubling of real revenues in a four-year window. Since our time frame is longer for India than China, this gives us higher figures for India which are not necessarily indicative of greater entrepreneurship or dynamism. In Figure 8, we show the intensity of gazelling in China, dividing the provinces into three groups – the top third in red, the next group in blue and the regions with the smallest share of gazelles in black. These are broadly similar to what economists familiar with China might expect - gazelles are more frequent on the coast and infrequent in the far West, the Northeast and the southeastern provinces bordering Vietnam, Laos and Myanmar. There are a couple of exceptions to this pattern. An island of central gazelling in Sichuan, Chongqing and Hunan shows up clearly, along with Inner Mongolia, Shanxi and Hebei. Of the three large coastal centers, Fujian (32.4 percent) ranks first, and Guangdong (29.0 percent of firms are gazelles) clearly outperforms Shanghai (25.6 percent) and Beijing/Tianjin (21.0 percent). Zhejiang (27.1 percent) does not rank quite as high as one might expect.

The question arises as to whether we can see evidence of China's "Going West" policy in the data on gazelles – are the shares of gazelling in the West catching up to those in the East? We address this on a preliminary basis in the following section.

Similarly, the geographic profile of gazelling in India is shown in Figure 9. The top regions for gazelling are Haryana, Andhra Pradesh, Gujarat, Chhattisgarh and Delhi. Some of the remoter regions have no firms which have ever been gazelles (Jammu and Kashmir, Nagaland) or even no firms in the Prowess dataset. Each of the most rapidly growing regions has a significant commercial center (Chandigarh in Haryana, shared with Punjab; Hyderabad in Andhra Pradesh; Ahmedabad in Gujarat; and Raipur in Chhattisgarh). Notably, three of the top five states with the most gazelles also rank in the top five in economic freedom according to the Cato Institute (2011), with Gujarat ranking 2<sup>nd</sup>, Andhra Pradesh 3<sup>rd</sup> and rising, and Haryana 4<sup>th</sup> among the 20 states which are ranked. The four least free states (Bihar, Uttarakhand, Assam and Orissa) are all among the bottom third in gazelling. The rank correlation for the 20 states with scores between gazelling and economic freedom is .51, suggesting a strong link between subnational policy and entrepreneurship.<sup>6</sup> This is even more striking considering that the ranks are for 2009 only, while the data on gazelling go back to 1989, and suggests that the policy differences between Indian states may be persistent. The exception is Chhattisgarh, with a lot of rapidly growing firms but

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<sup>6</sup> One important difference in policies across states that could affect firm growth are labor policies which affect the ease with which firms can lay off workers or shut down (Hasan and Jandoc 2012).

only ranking 16<sup>th</sup> of 20 in economic freedom. The principal industries in Chhatisgarh are steel and electricity, which may relate to the policy environment differently.

When only manufacturing firms are considered the correlation between the state-level propensity to gazelle and economic freedom drops to .26, suggesting that in India, liberal policies are more important for services than for manufacturing.

#### V. Ownership type, exporting, and gazelling

We use probit regression methods to analyze the effect of exporting and ownership type on gazelling, conditioning on age and firm size, both of which we expect to be negative. The enterprise types are different for India and China. There are ten enterprise types for China (state-owned, collective, equity cooperative, joint ownership, limited liability corporations, share-holding corporations, private enterprises, other domestic enterprises, foreign-funded enterprises, and enterprises with funding from Hong Kong, Macao and Taiwan (HMT) and four for India (state-owned, private foreign, private group and other private). These deserve a caveat and an explanation. In China, the various structures of share-holding, joint ownership and so on are not always a guide as to ultimate control. The majority of shares in a share-holding corporation may belong to a state organization; a joint ownership company may be effectively controlled by foreigners; a collective (aka “township and village enterprise”) may be in fact owned by a domestic Chinese owner as a “red hat” company in order to obtain access to local government; and so on. In India the category “private group” denotes firms that belong to a larger ownership group (known variously as “business group” and “industrial group”), such as Tata, Reliance, or Birla. Many private groups are family-based. Some older groups have evolved from the managing agencies of the British colonial period (Kling 1966); new groups are being formed on a regular basis.

The results for China are presented in Table 6. Consistent with other literature on gazelles, younger and smaller firms are more likely to gazelle. More interestingly, we have found significant and positive results for both of our exporter variables, the lag of exporter, which indicates a firm exports the year before the gazelle period, and the exporter variable, which indicates a firm exports the first year of the gazelle period. These results imply that firms that are exporting are more likely to become a gazelle. In addition, this regression gives us insight into how the ownership of the firm impacts its ability to grow rapidly. Private and other domestic enterprises are those most likely to become gazelles, followed closely by foreign funded enterprises. State-owned enterprises, the excluded category in this regression, are those least likely to become gazelles. An important caveat to this conclusion is that these are the official registrations of these companies and do not necessarily reflect the equity stake of the different owners. For instance, some of the most famous state-run companies like Baosteel and SINOPEC are recorded as share-holding companies because a small portion of the company is publically traded. Therefore we cannot take these probit results as the final word on the successfulness of state owned companies in China.

The results for India, like those for China, confirm the results for age and size found in the literature on gazelles. *Ceteris paribus*, smaller firms and younger firms are more likely to grow fast. The negative

association of exporting with gazelling observed earlier is found here when conditioning on other variables. (Table 7) This causes one to suspect the role of services in the sample. From an enterprise standpoint, both private foreign companies and private group companies are more likely to be associated with gazelling, with state-owned enterprises holding the last place as in China, about equal to Indian domestic private companies which are not part of a group. Table 8 presents the results for the subset of manufacturers only. There is still a negative association between exporting and gazelling, though the estimated effect is smaller than for the full sample. This suggests that manufacturers focusing on the Indian market in fact have had better growth opportunities than those who export. Among manufacturers, the effect of age becomes negligible (possibly because of pre-Independence firms who became gazelles in the recent period) and the advantage of private groups over other firms disappears, with private foreign firms standing alone in their superiority in terms of growth.

## VI. Gazillas

One feature of both the China and India datasets is that it is possible to read the names of the firms. This feature is usually not shared by industrial censuses conducted by OECD governments, but is shared with business databases such as Dun and Bradstreet and Orbis. In our exploratory work, we noticed that Infosys, the Indian software giant, was on our list of gazelles, and that it had maintained rapid growth for a long period of time. This led us to wonder whether very large gazelles might be part of the Indian and Chinese scenes, and had not been identified before due to the use of business-confidential data.

In an informal attempt to look at the presence of “gazillas” globally, we employed a stock screener available at Fidelity.com. The stock screener enables the user to search a database of over 6,000 equities tradable through Fidelity by criteria – admittedly a selective sample, but a convenient one. We chose firms with \$5 billion or more of revenues in the most recent year available (generally 2011) whose nominal revenues had doubled in a five-year period. This is not quite as stringent a filter as we have been using for India and China. The procedure identified about 70 firms in a variety of sectors, of which about half are in the United States. Among the more notable gazillas in the United States are Apple, CVS Caremark, Amazon, Google, Las Vegas Sand, and Community Health Systems in the United States. There was one in Japan (Nintendo), one in Russia (Gazprom) and nine in Brazil, in sectors including banking, chemicals, food products, utilities and retailing. The largest of the gazillas in this group was Petrochina, with revenues of \$334 billion (over twice those of Apple) and a compounded annual growth of 29 percent (vs. 41 percent for Apple).

One can say “as American as Apple” (with or without the pie), “as Russian as Gazprom,” “as Japanese as Nintendo.” The idea arises that gazillas are the largest, most successful businesses in an economy, and may reveal a number of environmental features about the business, policy, and technological climate in a country, or what Alfred Marshall (1920) would have characterized as “the industrial leadership” of a nation included among the group of leaders.<sup>7</sup> If the largest animal in the Jurassic period was Brontosaurus, we can infer that the environment consisted of large swamps rich in plant material and suitable for bearing the weight of a large animal, and perhaps other things. We know a lot about the U.S. economy from an examination of Apple – people are wired, global fragmentation of production is important with the United States taking the lead in research (Linden et al. 2007), consumers care about novelty and style, and so on. Should we be saying “As Chinese as Petrochina”? “As Indian as Infosys”? And if so, what would we mean by that?

Table 9 lists some notable gazillas in China. Firms on the list were among the top 30 in revenue for at least four years, which do not need to be consecutive, and to have had at least two or more periods as a

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<sup>7</sup> For example, in Marshall the industrial leadership of Britain consisted of “massive production,” for France “individuality and refinement in production,” for Germany “science in the service of industry,” and for the United States “multiform standardization.”

gazelle. This leaves a list of 17 companies. By far the largest Chinese gazilla is Hongfujin Precision Industrial (Wuhan) Co. Ltd., a Chinese subsidiary of Hon Hai Precision Industry, the company commonly known as Foxconn. Foxconn is an “original design manufacturer” headquartered in Taiwan, the final assembler for Apple as well as Acer, Cisco, Intel, Nokia, Samsung, Sony and other global electronic firms. It is striking that the greatest Chinese gazilla is in fact a business partner of the greatest American gazilla.

Other notable foreign-owned gazillas in Japan include Nokia and Dell in electronics. Lenovo, the computer company that grew by acquiring IBM’s PC division, is Hong Kong-based. Gazilla joint ventures include Shanghai General Motors and Guangzhou Honda. Both Huawei and ZTE, the makers of telecom equipment, routers and other Internet backbone components are included

We present two looks at gazillas in India - the first is based on revenues using the same criterion as China, and yields 18 firms (Table 10). Of these, seven are state-owned enterprises, eight are members of private groups, and one is a private domestic firm (Gitanji Gems). Two are foreign-owned subsidiaries of Unilever – Hindustan Unilever (in cosmetics, soaps, toiletries and detergents), and Brooke Bond Lipton India Ltd. (in tea). The largest Indian gazilla, and also the largest company in Prowess, is Reliance Industries Ltd., the petroleum-refining subsidiary of Reliance Industries. Three are members of Tata Group. Four predate independence (Brooke Bond Lipton dates from 1912) but have had at least some period of flourishing under reform. Two were founded in the reform era – Bharti Airtel, India’s leading cell phone provider, part of the newer Bharti Group, and Tata Consultancy, both established in 1995.

Our second look at Indian gazillas includes firms which have consistently shown rapid growth (Table 11). There are 22 firms which have had gazelle status for five or more of the 16 periods we observe. Most notable among these is Infosys, provider of business consulting, software and outsourcing services. Infosys has doubled real sales for an astonishing 14 out of our 16 observable periods, covering 20 years, and is now the 13<sup>th</sup> largest firm in Prowess. Satyam and Wipro are other software services in the same space. The gazillas with sustained growth are dominated by private groups, which account for 17 of the 22 “most consistent” gazillas. Two of the “most consistent” gazillas were founded during the reform area, and one of these is also a cell phone company – Idea Cellular, which is part of the venerable Birla group.

a. A story of India – Mobile-phoning a subcontinent

Long-time visitors to India remember when land lines were scarce, it was necessary to “book a call” for intercity communications, and the call did not always go through or went through after a long delay. In the last decade, cell phone access in India has leapfrogged landlines, with cell subscriptions going from almost nil in 1999 to 60 per 100 people in 2010 (Figure 11). We counted both firms and gazelles for the “telecom and post” industry in India. In the first window (1989-92) there is only one firm, the state monopoly. As reform starts more firms enter, but only a minority of them are gazelles, as if they are competing against headwinds. Entry continues throughout our period, and the probability of any given firm in the sector being a gazelle goes up steadily after about 1999 (compare Figure 7).



We utilize the historical profile of Indian service reforms in Arnold, Javorcik, Lipscomb and Mattoo to overlay the development of telecom sector policy with the entry of firms into Prowess and the evolution of gazelles (Figure 12).<sup>8</sup> Broadly speaking, the public sector dominated Indian telecommunications prior to reform. The first private industrial networks emerge in industrial areas in the early 1990s, with private cell providers actually entering shortly afterwards, often with minority foreign equity. The introduction of the Second New Telecom Policy in 1998-99 leads to an increase in the number of firms enjoying rapid growth. By about 2002 the domestic long-distance cellular network was fully liberalized, with a remaining public monopoly on international gateways.

The two new gazillas we have identified in the cell phone sector have played a key role in the wireless connection of India. Both of them have adopted unique managerial strategies to cope with the combination of enormous pent-up demand and a rapidly changing regulatory environment. Bharti Airtel had 200 million customers as of 2012. Its uniqueness consists in part of its extensive use of outsourcing, possibly being the first cell provider to outsource all of its core functions (physical network to Ericsson, Nokia Siemens and Huawei; business process functions to IBM), retaining marketing, sales, and finance as its core functions. The Airtel model also works in other difficult environments. Airtel operates in 20 countries, mostly in Africa, and is in 1<sup>st</sup> or 2<sup>nd</sup> place in 12 of these markets. The Bharti model of partnering with foreign firms to take advantage of market spaces opened up by reform and deregulation also operates in other sectors in India, including the Bharti Walmart partnership in retailing, and partnerships with Del Monte in food distribution and AXA in insurance.

Idea Cellular, founded the same year as Airtel (1995), was originally Birla Communications Ltd., having obtained licenses for Gujarat and Maharashtra. Since each bidder only received initial licenses for certain metropolitan areas, the problem for Idea, as well as its competitors, was to establish a national network. Idea's strategy for this was to form partnerships with both foreign firms and Indian rivals. Birla-Tata-AT&T Cellular was formed after a series of mergers in 2001. (As India's two most well-known industrial groups based on both size and history, a Birla-Tata partnership has something of the ring that a GM-Ford or Coke-Pepsi partnership would have in the United States). Idea became a pan-India operator in 2009.

#### b. A story of China – State-owned gazillas

At least four of the gazillas can be traced to state ownership – Baosteel (Baoshan Iron and Steel Compan), North China Grid (also known as State Grid), SINOPEC Maoming (a subsidiary of China Petroleum and Chemical Corporation under the SINOPEC umbrella), and Jinan Iron and Steel. To give an idea of the size of the Chinese oil companies, SINOPEC Maoming is one of over 100 subsidiaries of SINOPEC, based in Guangdong and combining refining, power generation and port facilities. Petrochina is similarly structured, with subsidiaries of either qualifying as gazillas (SINOPEC focuses mainly on refining but also does extraction, and Petrochina focuses on extraction but also does refining).

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<sup>8</sup> Greene (2004) provides additional background on the development of India's telecom liberalization.

The largest Chinese SOEs have emerged through a turbulent period of restructuring. Production in key sectors like oil, steel and electricity was originally done in ministerial units. In 1992, the 14<sup>th</sup> Communist Party Congress (CPC) announced the objective of creating a modern corporate system within socialism. By 1993, corporations were given legal standing under the new corporate law. In 1997, the 15<sup>th</sup> CPC established the shareholding system at the center of enterprise restructuring (Jefferson and Singh 1999).

The number of SOEs was reduced in a period of consolidation, allowing more successful SOEs to consolidate. Notably, Baosteel expanded by merger and consolidation with other SOEs in 1998 and 2008. SINOPEC has expanded more organically, mostly by importing vast quantities of oil and processing it. Both firms have also expanded by outward foreign investment – Baosteel has 8 foreign subsidiaries. Of the 321 million barrels of crude oil processed by SINOPEC in 2011, around 20 million came from overseas operations. Baosteel and Sinopec both exemplify the drive for growing large SOEs expressed by SASAC, the asset-supervision entity for large SOEs established by the State Council in 2003. SASAC policy has emphasized moving as many SOEs as possible into the Global Fortune 500 (Naughton 2012). Using the Forbes Global 500 list, SINOPEC ranked 5<sup>th</sup> in 2011, Petrochina ranked 6<sup>th</sup> and State Grid ranked 7<sup>th</sup>. Baosteel ranked 212<sup>th</sup>, and was the third largest steel producer in the world.

## VII. Conclusion

As Los Angeles was the city of a million stories in the television series *Dragnet*, so we have only scratched the surface of the narratives and lessons that could be drawn from the gazillas and gazelles of India and China. We have not discussed the conditions under which software developed in India, the rapid growth of the Chinese automotive industry, and the reasons for the apparent inward orientation of much successful manufacturing production in India and China – though the role of the state appears to be important in both cases. We have just begun to tease out the connections between age, exporting, size, and rapid growth in a statistical sense. We don't know why Indian private groups occupied so much of the space made available by reform, relative to domestic private companies.

Nonetheless, we think we have a few important lessons. Exports are a successful path to growth, but so are sales to a rapidly growing domestic market. Foreign-invested firms perform well in all kinds of environments. State-owned firms are less likely to grow rapidly on average, but there are a lot of exceptions to the average.

Besides developing the India and China stories further, we would like to see what can be learned about gazelles and gazillas in other developing countries. They appear to be important in Brazil. A more rigorous global profile of gazillas, developed perhaps from a proprietary firm-level database such as Dun and Bradstreet or Orbis, could yield valuable lessons.

## REFERENCES

- Acs, Zoltan J., William Parsons and Spencer Tracy, "High-Impact Firms: Gazelles Revisited," for U.S. Small Business Administration Office of Advocacy, 2008 (June).
- Alfaro, Laura, and Anusha Chari, "India Transformed? Insights from the Firm Level 1988-2005," Harvard Business School Working Paper 10-030, 2009 (October).
- Arnold, Jens Matthias, Beata Smarzynska Javorcik, Molly Lipscomb and Aaditya Mattoo, "Services Reform and Manufacturing Performance: Evidence from India," World Bank Policy Research Group Working Paper No. 5948, 2012 (January).
- Birch, David L., Anne Haggerty and William Parsons, "Who's Creating Jobs?" Cambridge, Mass.: Cognetics, 1993.
- Birch, David L., Anne Haggerty and William Parsons, "Who's Creating Jobs?" Cambridge, Mass.: Cognetics, 1995.
- Birch, David L., Anne Haggerty and William Parsons, "Entrepreneurial Hot Spots: The Best Places in America to Start and Grow a Company," Cambridge, Mass.: Cognetics, 1994.
- Brown, Charles, James Hamilton, and James Medoff, *Employers Large and Small*. Cambridge: Harvard University Press, 1990.
- Cato Institute, *Economic Freedom of the States of India: 2011*, Washington, DC: Cato Institute. Available at <http://www.cato.org/economic-freedom-india/>
- Davis, Steven J., John Haltiwanger and Scott Schuh, *Job Creation and Destruction*. Cambridge, Mass., MIT Press, 1996.
- Greene, William, "The Liberalization of India's Telecommunications Sector: Implications for Trade and Investment," U.S. International Trade Commission Working Paper 2004-09-B, 2004 (September).
- Haltiwanger, John C., Ron S. Jarmin and Javier Miranda, "Who Creates Jobs? Small vs. Large vs. Young," NBER Working Paper 16300, 2010 (August).
- Haltiwanger, John C. and C.J. Krizan, "Small Business and Job Creation in the United States: The Role of New and Young Businesses" in Zoltan Acs, ed., *Are Small Firms Important? Their Role and Impact*, Kluwer, 1999.
- Hasan, Rana, and Karl Robert L. Jandoc, "Labor Regulations and the Firm Size Distribution in India Manufacturing," Paper 4 for Conference at Columbia University on "India: Reforms, Economic Transformation and the Socially Disadvantaged," 2012 (September).

Henrekson, Magnus, and Dan Johansson, "Gazelles as Job Creators: A Survey and Interpretation of the Evidence," *Small Business Economics* 35, 227-224, 2010.

Jefferson, Gary H. and Inderjit Singh, *Enterprise Reform in China: Ownership, Transition, and Performance*. Oxford University Press for the World Bank, 1999.

Kling, Blair B., "The Origin of the Managing Agency System in India," *The Journal of Asian Studies* 26:1, 37-47, 1966 (November).

Linden, Greg, Kenneth L. Kraemer and Jason Dedrick, "Who Captures Value in a Global Innovation System? The Case of Apple's iPod," Personal Computing Industry Center working paper, Irvine, California, 2007 (June)

Marshall, Alfred, *Industry and Trade: A Study of Industrial Technique and Business Organization; and of their Influences on the Condition of Various Classes and Nations*. Third Edition, 1920. Available at <http://socserv2.socsci.mcmaster.ca/econ/ugcm/3ll3/marshall/Industry%26Trade.pdf>

Naughton, Barry, "Leadership Transition and the "Top-Level Design" of Economic Reform," *China Leadership Monitor* No. 37, 2012 (April). Available at <http://www.hoover.org/publications/china-leadership-monitor/article/116031>

Neumark, David, Brandon Wall and Junfu Zhang, "Do Small Businesses Create More Jobs? New Evidence for the United States from the National Establishment Time Series." *Review of Economics and Statistics* 93:1, 16-29, 2011 (February).

Wagner, Joachim, "Exports and Productivity: A Survey of the Evidence from Firm-level Data," *The World Economy* 30:1, 60-82, 2007 (January).

**FIGURES**

**Figure 1: Probability Density Function of Firm Revenues**

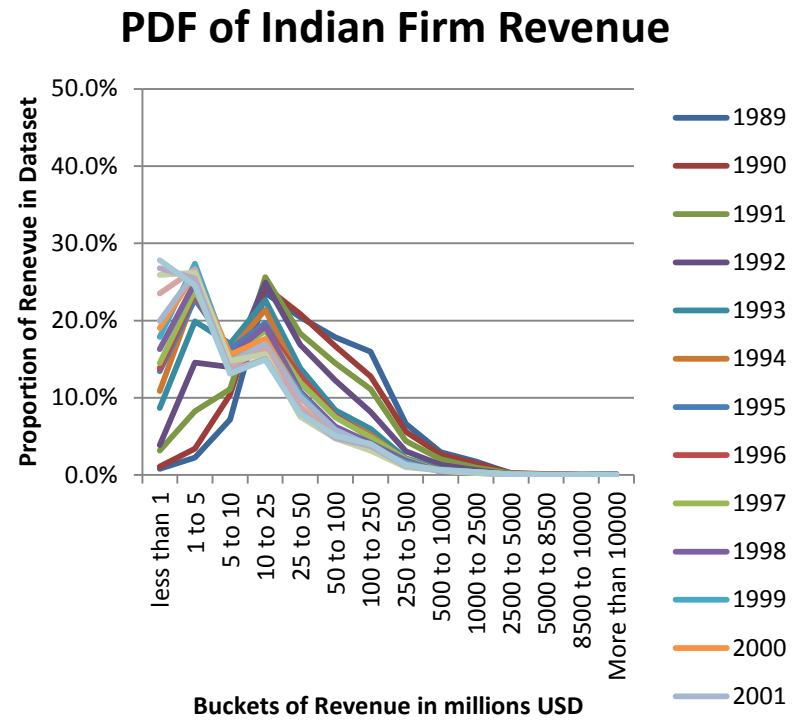
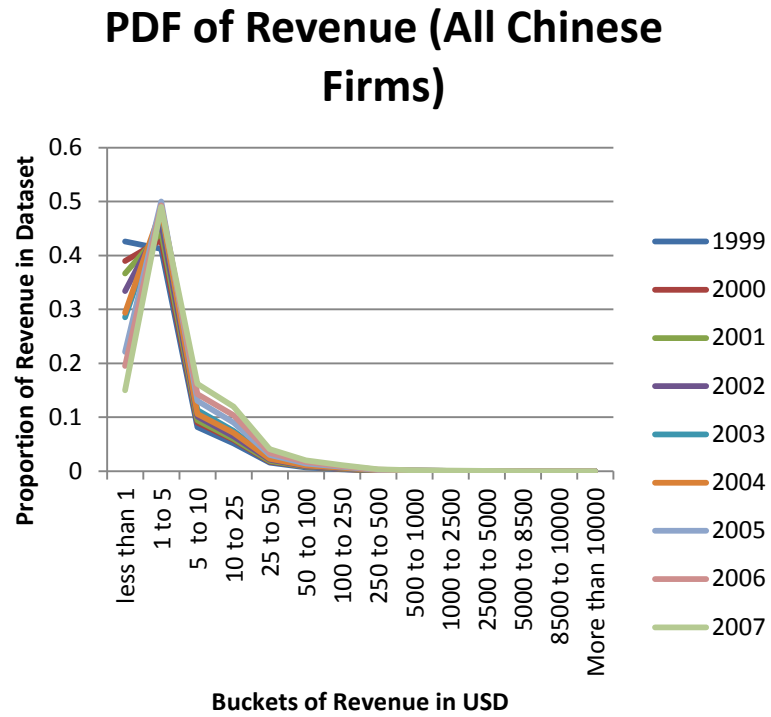


Figure 2: The peak in China's Gazelle intensity is consistent with China's export data

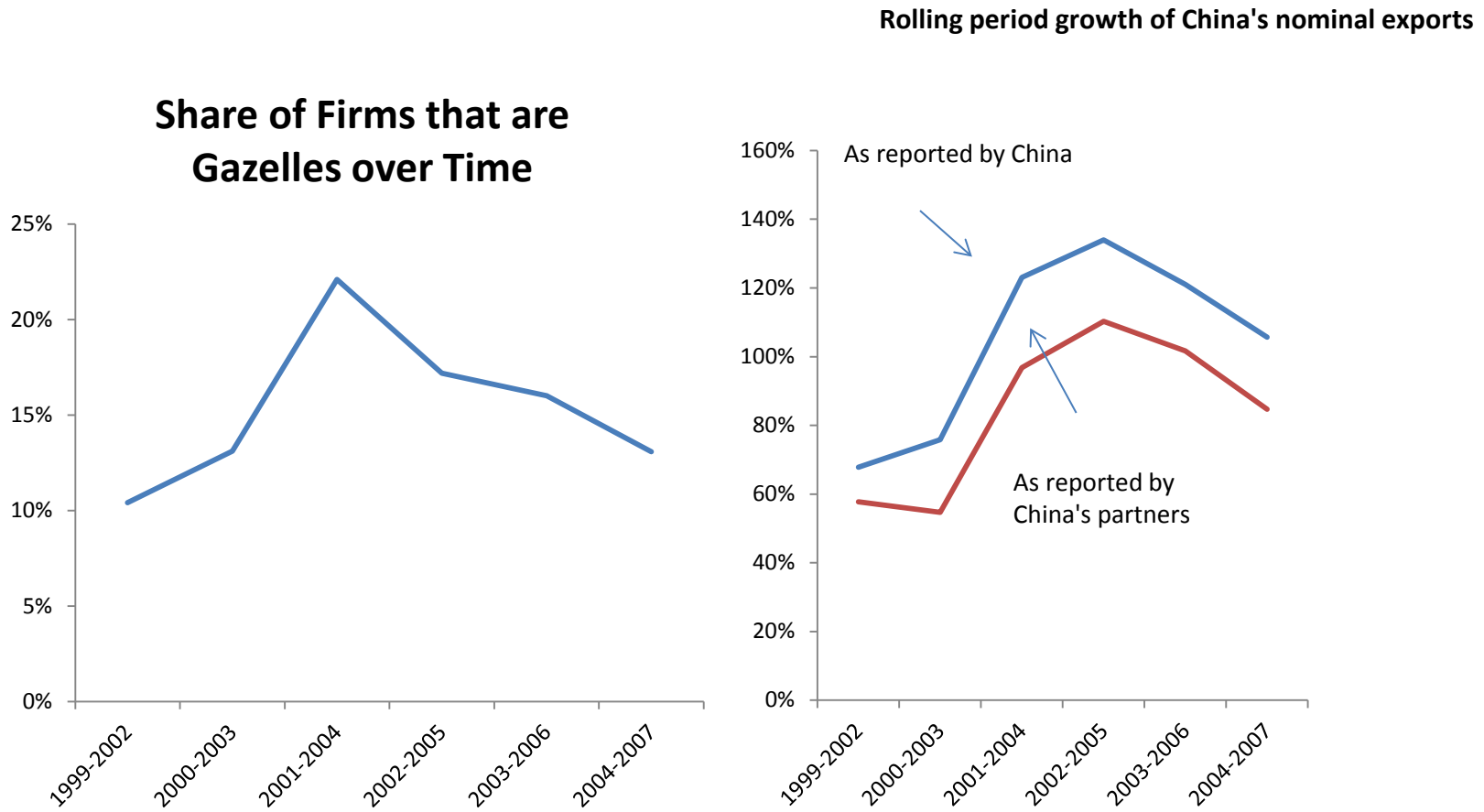


Figure 3: Indian Gazelles and the economy

### There are more gazelles when the macroeconomy is doing well

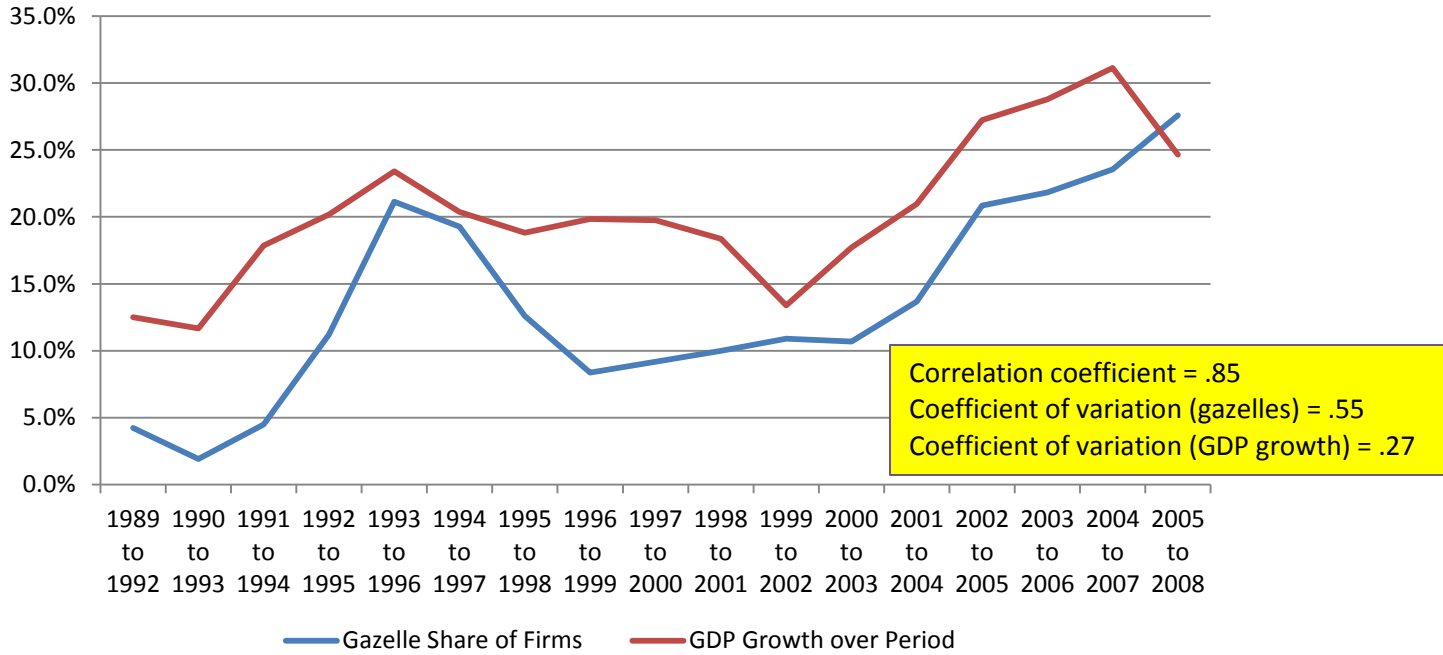
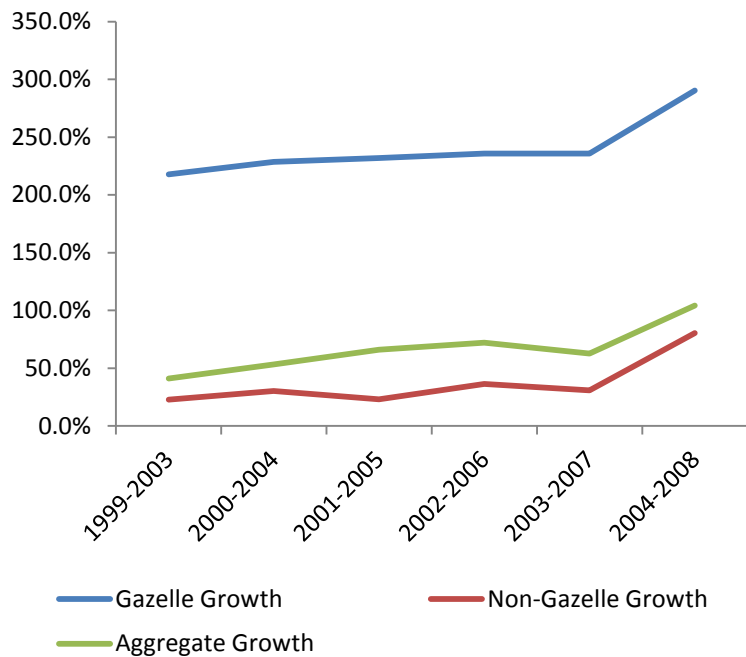


Figure 4: Chinese Gazelles and the economy

### Growth: Gazelles vs. Non-Gazelles



### Share of Growth due to Gazelles

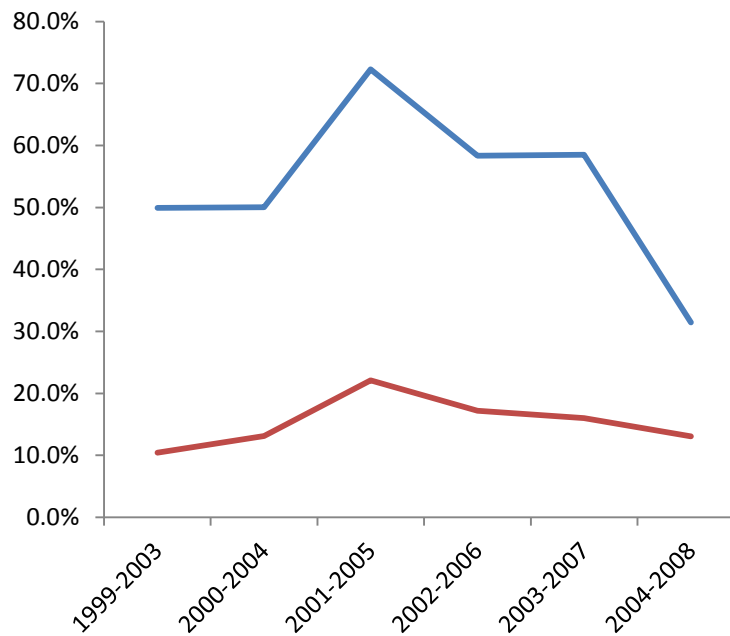
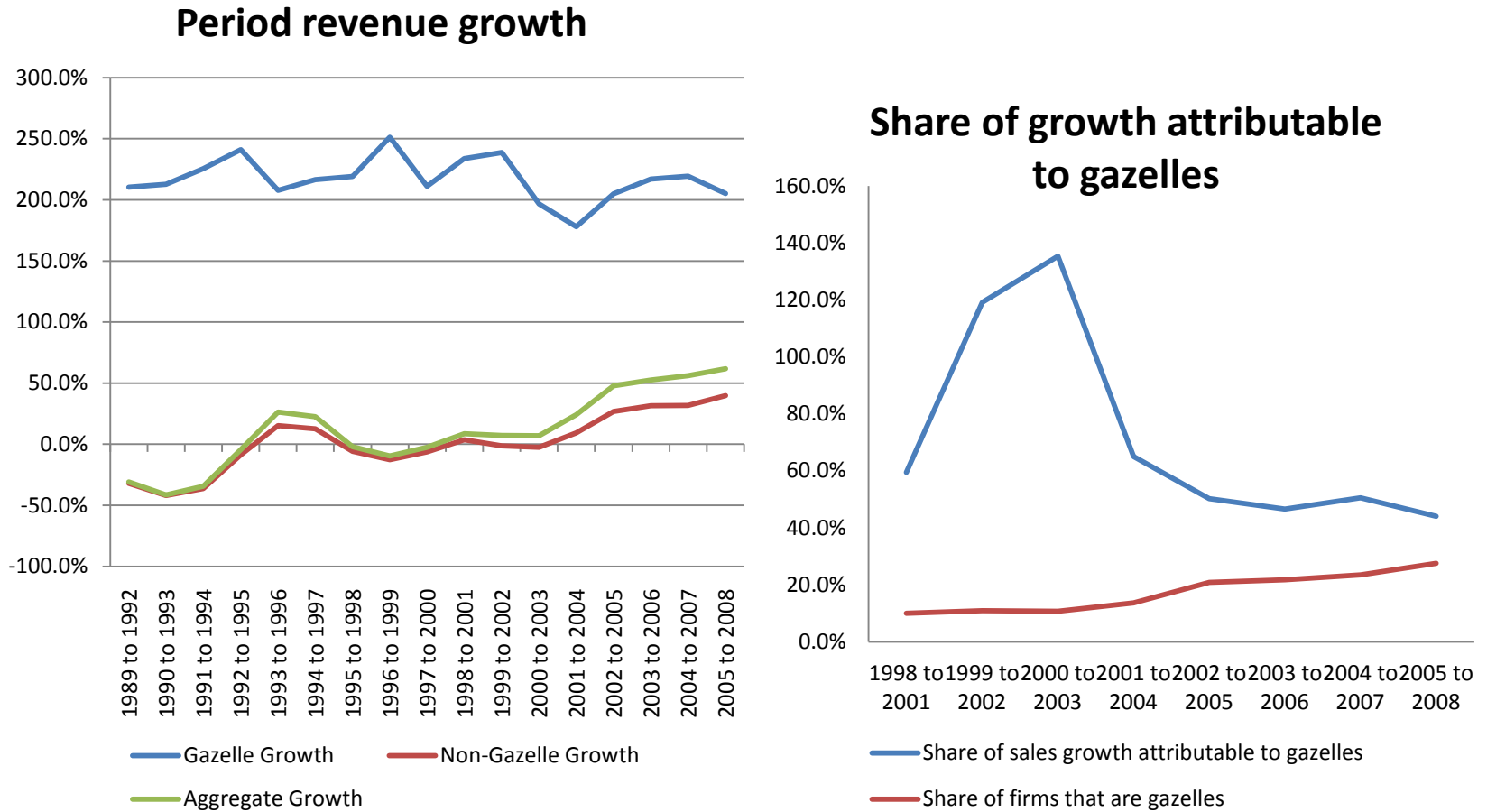




Figure 5: Indian gazelles account for more than 100% of sales growth until 2001-2004



Notes: The share of gazelle growth for windows ending in 1992-1995 and 1998-2000 is undefined, because of negative aggregate sales growth.

Figure 6: Gazelle Intensity by Industry (China)

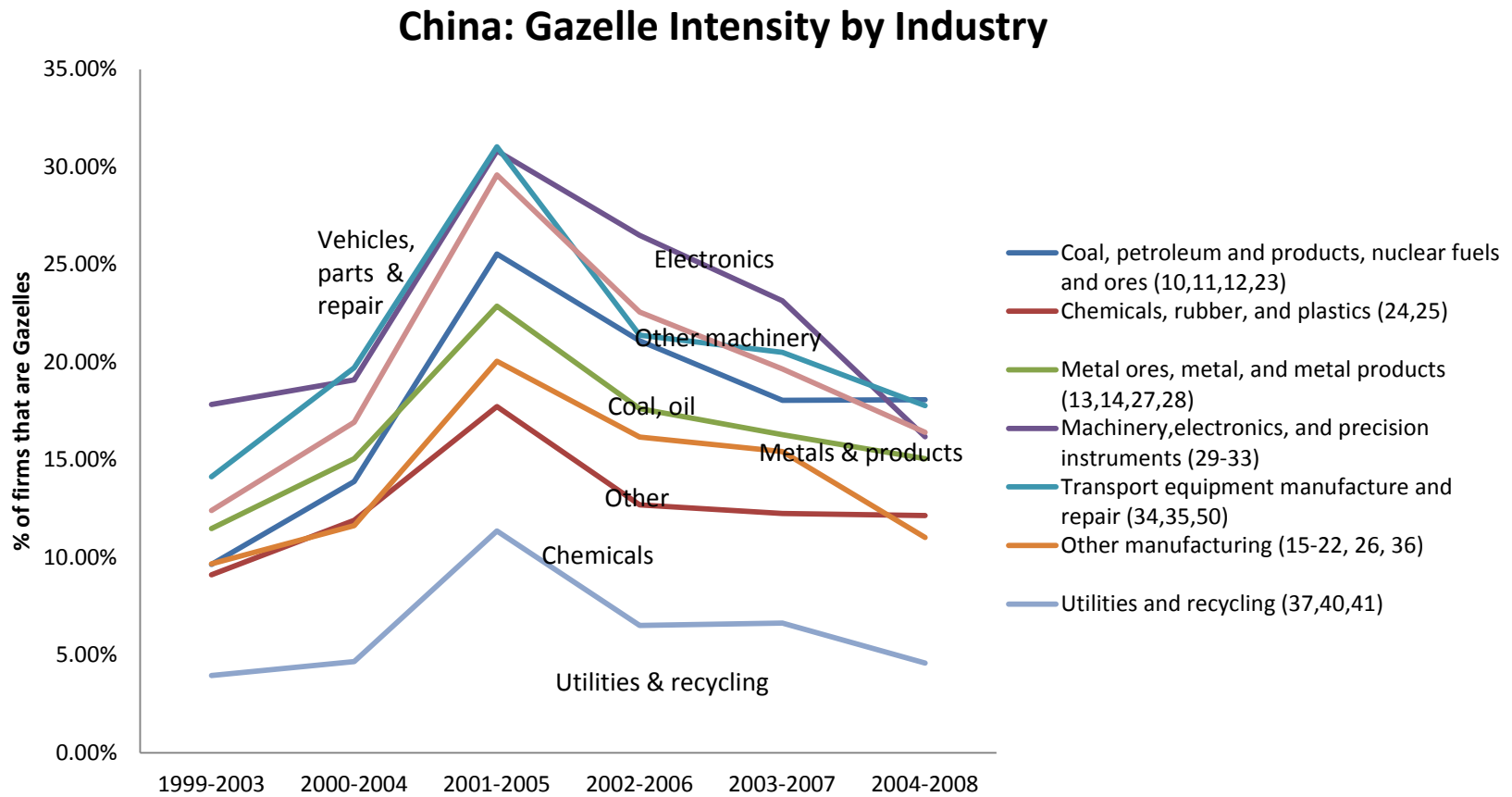


Figure 7: Gazelle Intensity by Industry (India)

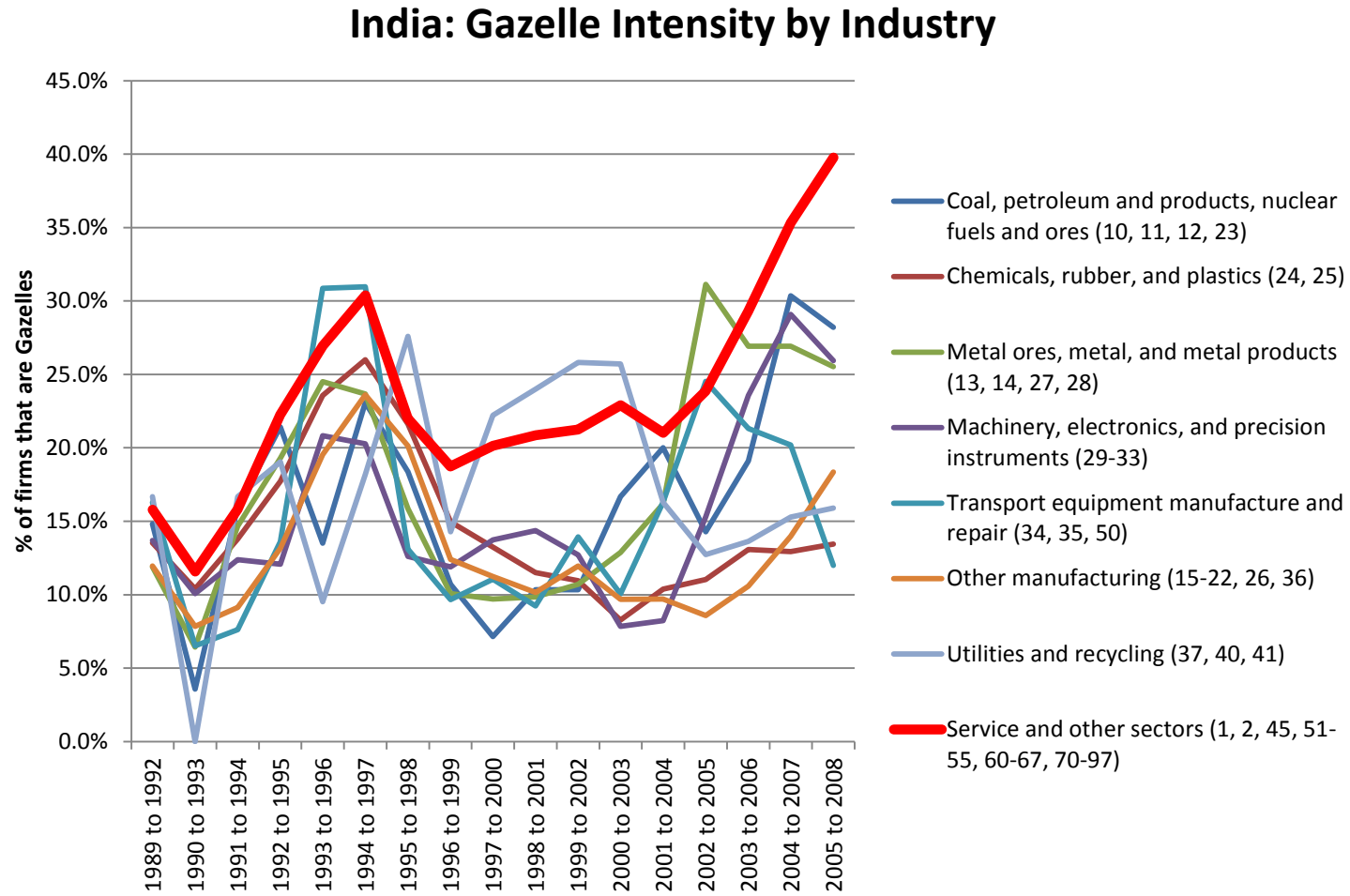


Figure 8: Share of firms in services (India)

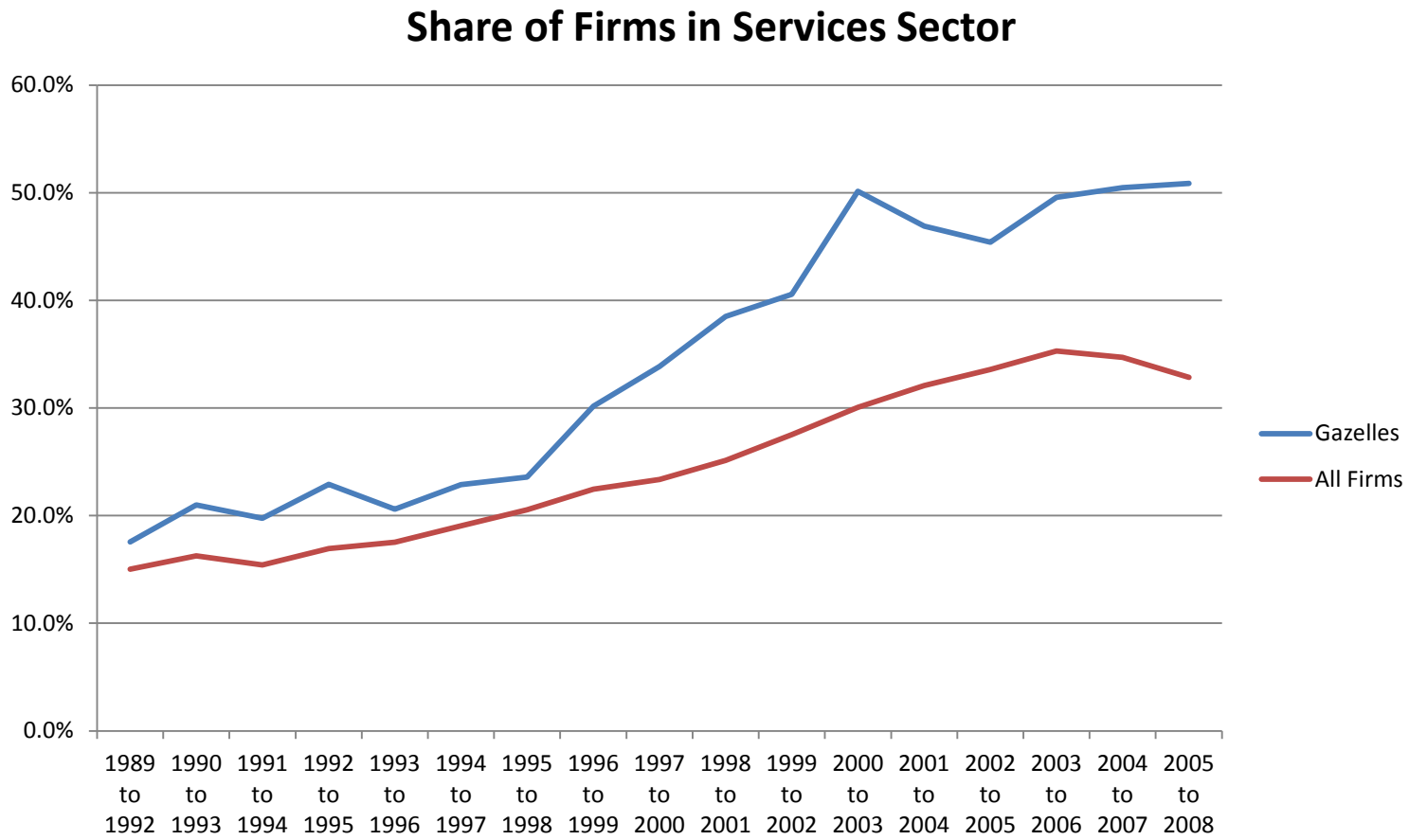


Figure 9: Gazelle Intensity for Services (India)

### India: Gazelle Intensity for Services

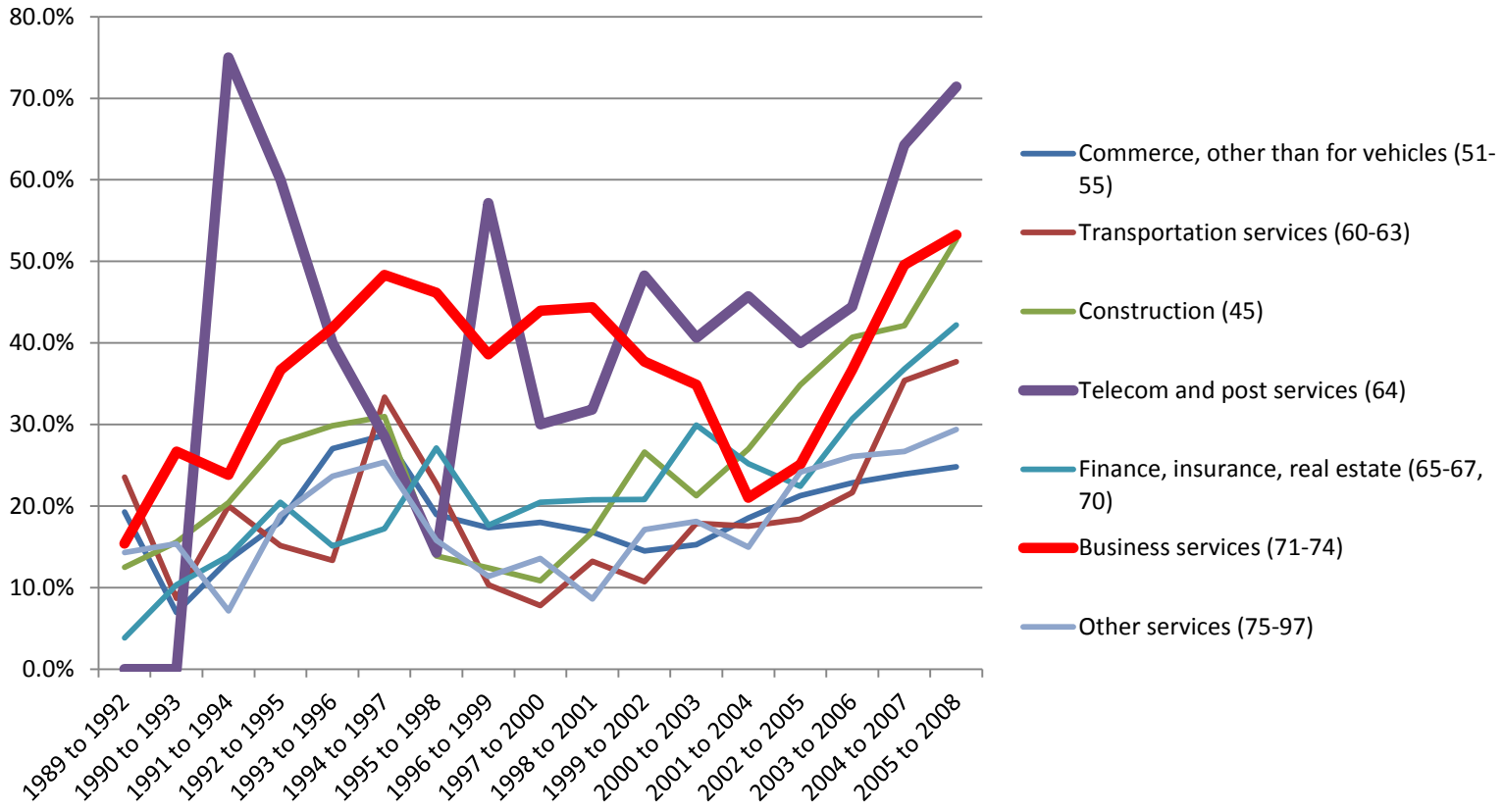


Figure 10: Location of Gazelle Intensity (China)

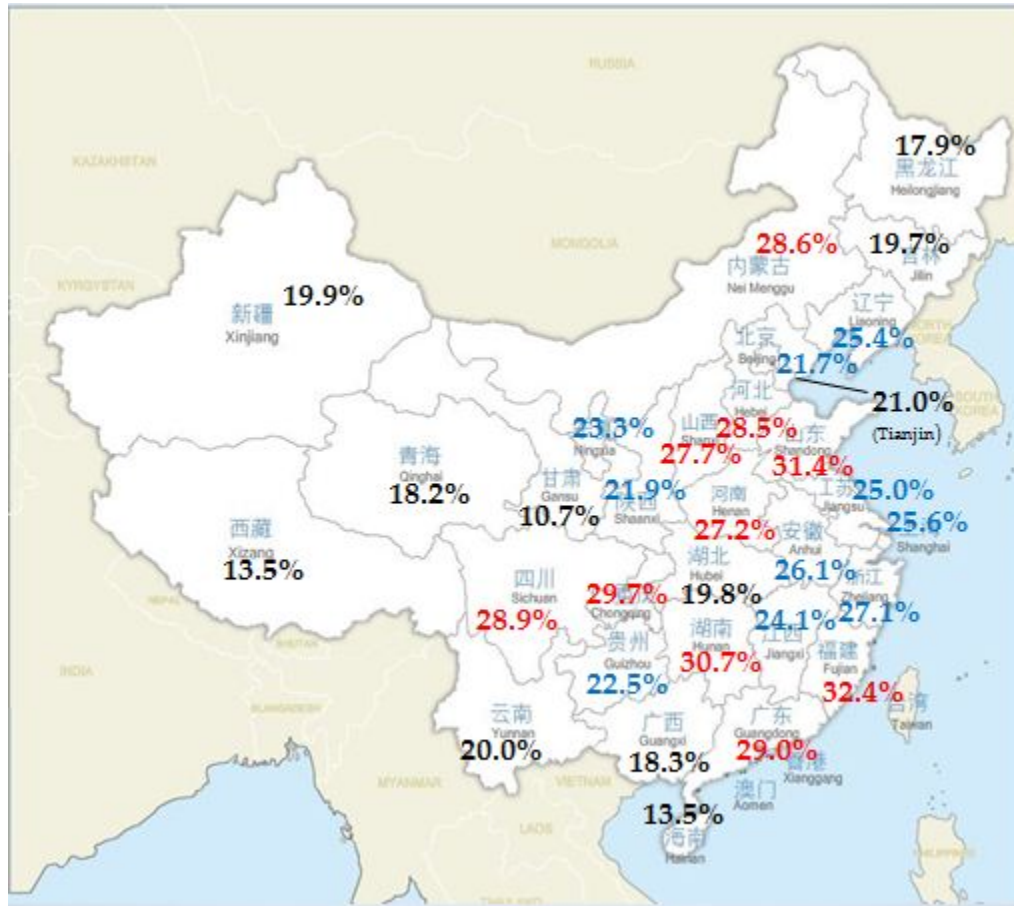


Figure 11: Location of Gazelle Intensity (India)

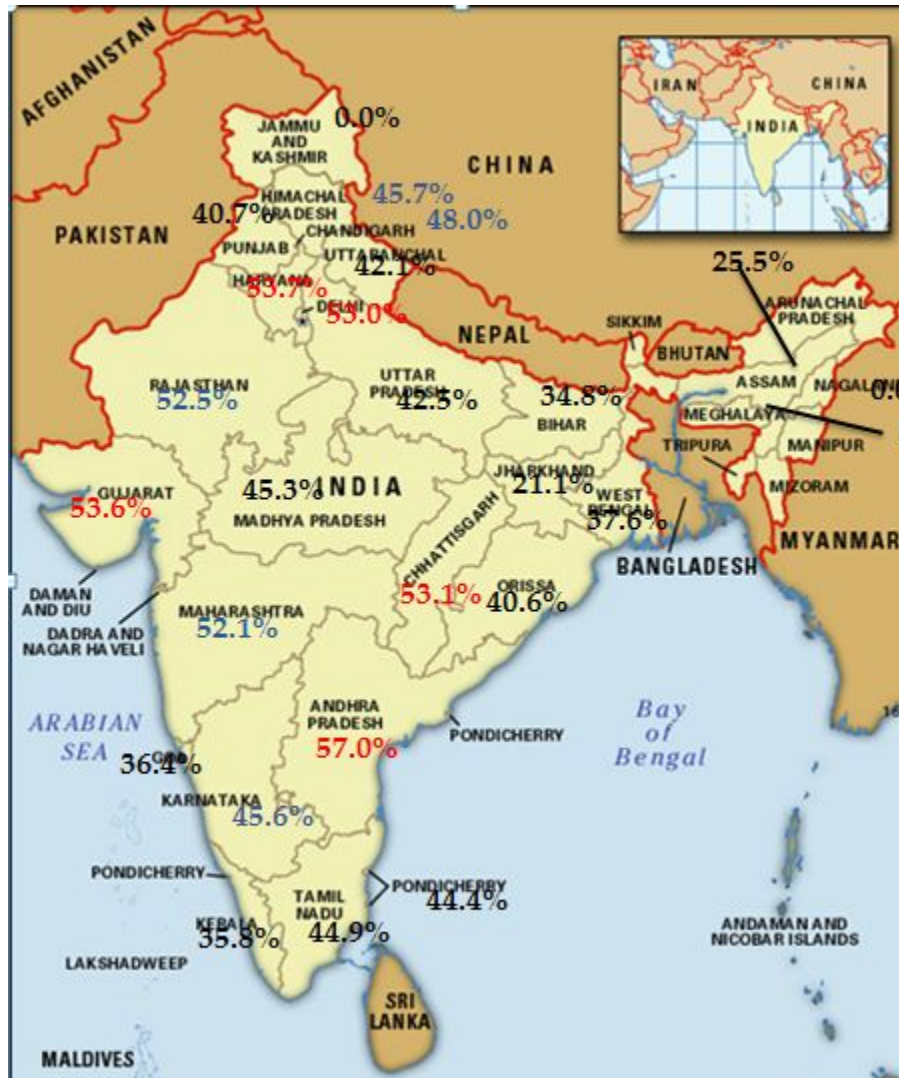


Figure 12: Telecommunications Penetration in India

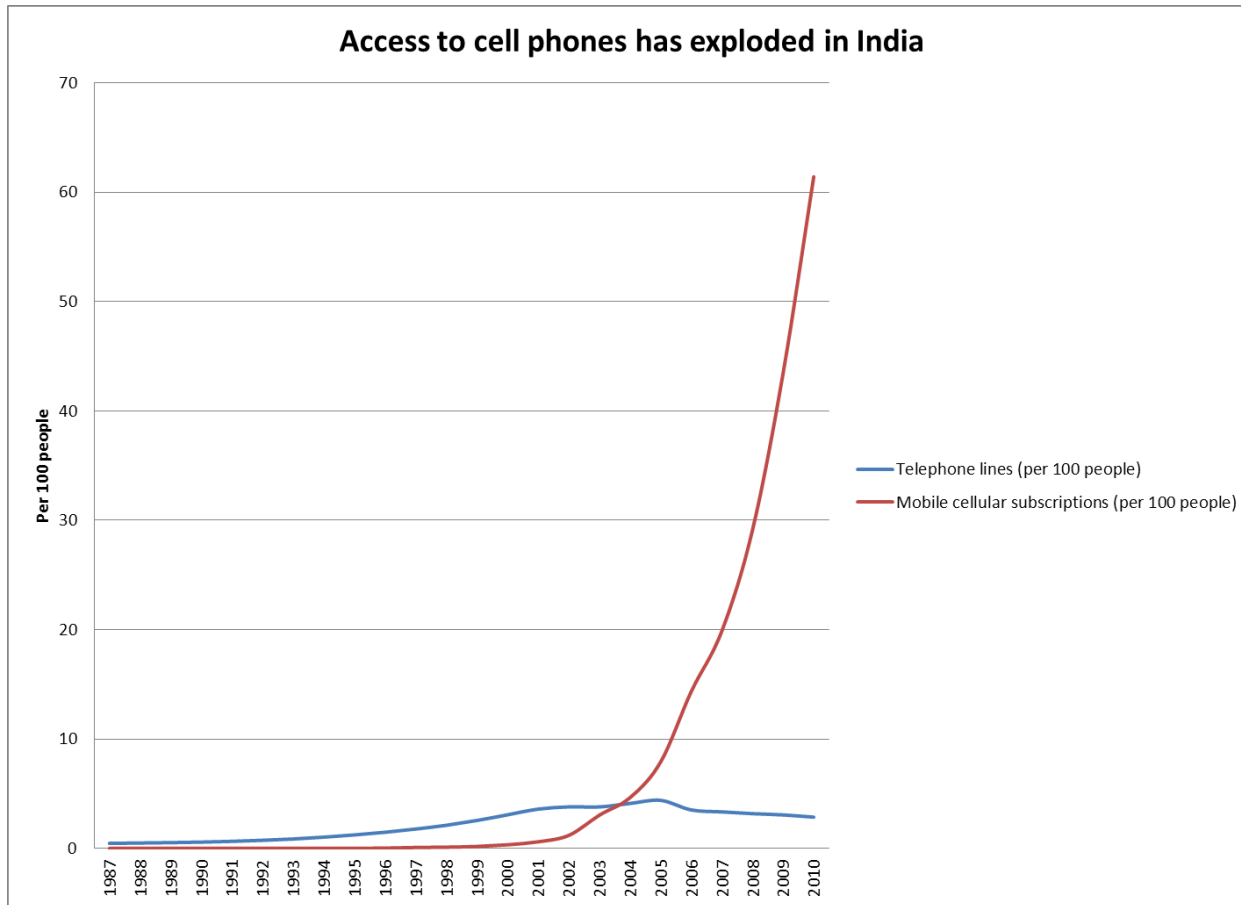
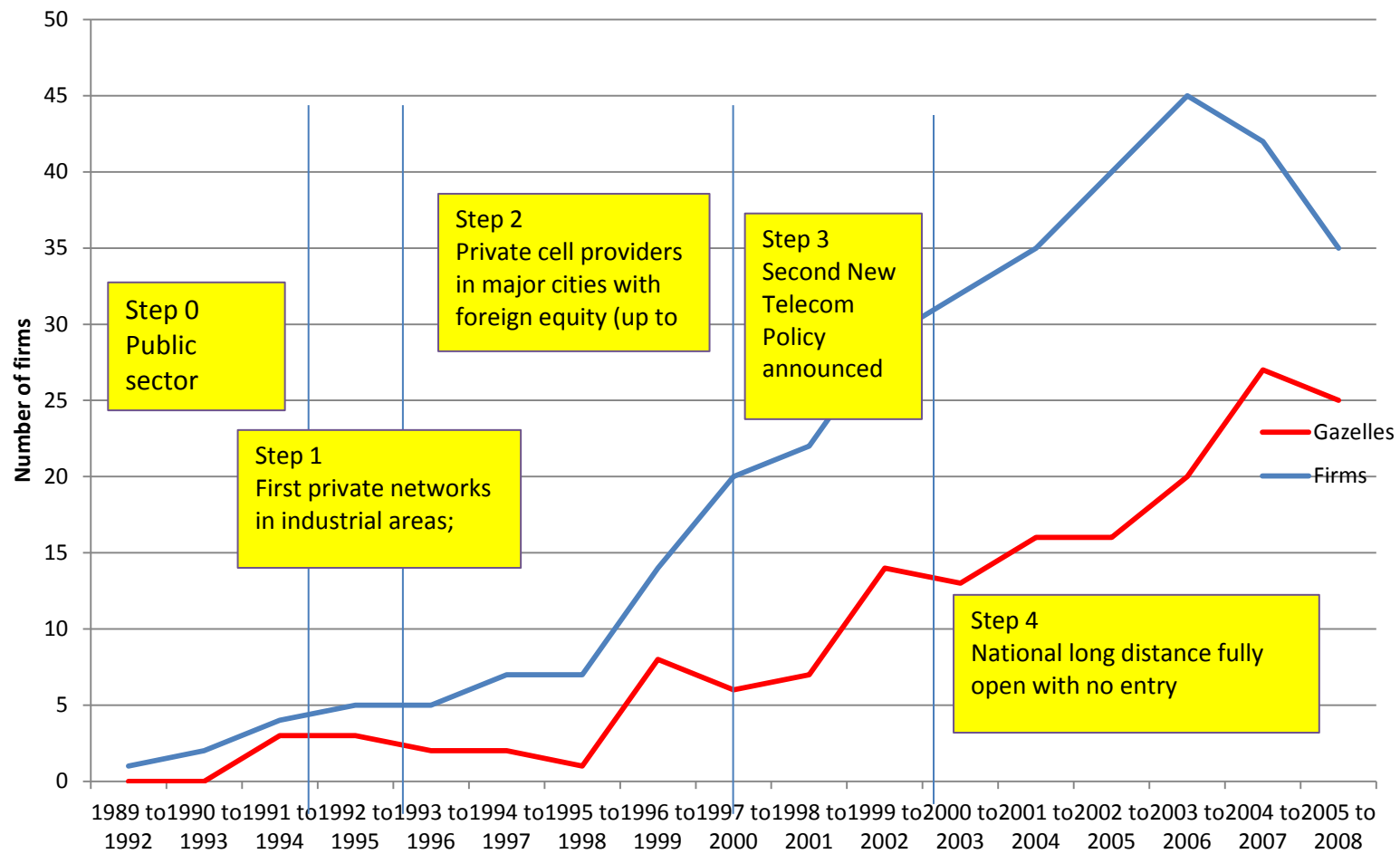




Figure 13: Telecom Gazelles and Reform



Notes: Periods taken from Arnold, Javorcik, Lipscomb and Mattoo (2012)

## **TABLES**

Table 1: Gazelles and Exporting (China)

### **Percentage of Firms that are Gazelles by Exporting Ability**

	1999-2002	2000-2003	2001-2004	2002-2005	Overall
Exporting Firm	12.7%	15.1%	24.4%	19.4%	37.9%
Number of Gazelles	2,554	3,485	6,803	6,137	16,343
Number of Non-Gazelles	17,507	19,592	21,102	25,572	26,772
Total	20,061	23,077	27,905	31,709	43,115
Non-Exporting Firm	9.6%	12.3%	21.1%	16.2%	29.3%
Number of Gazelles	5,297	6,969	14,034	11,699	27,766
Number of Non-Gazelles	50,063	49,691	52,354	60,338	67,088
Total	55,360	56,660	66,388	72,037	94,854

Table 2: Gazelles and Exporting (India)

### **Percentage of Firms that are Gazelles by Exporting Ability**

Period	1999-2002	2000-2003	2001-2004	2002-2005	2003-2006	2004-2007	2005-2008	Overall
Exporting Firm	5.6%	5.7%	8.9%	19.0%	18.8%	19.1%	21.8%	41.5%
Number of Gazelles	91	95	151	330	360	382	443	1228
Number of Non-Gazelles	1546	1586	1542	1409	1558	1618	1590	1730
Total	1637	1681	1693	1739	1918	2000	2033	2958
Non-Exporting Firm	15.4%	14.9%	17.7%	24.6%	27.9%	31.7%	35.6%	51.5%
Number of Gazelles	243	256	300	434	545	616	715	1176
Number of Non-Gazelles	1336	1463	1394	1331	1405	1326	1295	1107
Total	1579	1719	1694	1765	1950	1942	2010	2283

Table 3: Gazelles, Exporting and Age (China)

**Age and Exporter Cross Tabulation**

Age Bucket	Percentage of Firms in each Age Bucket			
	% of Firms that are	% of Firms that	% of Gazelles that	% of Non-Gazelles that
<=10	<b>17.7%</b>	40.9%	36.1%	31.5%
11-25	<b>10.3%</b>	26.9%	24.8%	19.3%
26-50	<b>6.1%</b>	24.0%	19.8%	16.4%
>100	<b>6.3%</b>	33.2%	24.6%	17.7%

Notes: Median age for all firms is approximately 8 years – median age for gazelles is approximately 6 years.

Table 4: Gazelles, exporting and age (India)

**Age and Exporter Cross Tabulation**

Era	Percentage of Firms from Era that:			
	are Gazelles	are Exporters	are Gazelles that Export	are Non-Gazelles that Export
Globalized (2001 on)	<b>63.8%</b>	28.8%	15.9%	12.9%
Postliberalized (1991-2000)	<b>59.7%</b>	49.6%	32.3%	17.3%
Post-Independence (1948-1990)	<b>27.5%</b>	75.5%	20.8%	54.7%
Pre-independence (before 1948)	<b>44.6%</b>	68.9%	33.1%	35.8%
N=	<b>9312</b>	5960	5960	5960

Table 5: Gazelles and Exporting (China)

<i>Industry Name</i>	<i>ISIC Rev.</i>	Percent of Gazelles that Export					<i>Number</i>
		<i>1999-2002</i>	<i>2000-</i>	<i>2001-</i>	<i>2002-</i>	<i>1999-</i>	
Manufacture of furniture; manufacturing n.e.c.	36	60.6%	61.2%	65.7%	66.8%	70.5%	2,591
Manufacture of wearing apparel; dressing and dyeing of fur	18	64.4%	64.5%	61.6%	61.1%	69.8%	2,677
Manufacture of radio, television and communication	32	60.6%	61.2%	67.2%	62.6%	68.0%	2,616
Manufacture of office, accounting and computing machinery	30	49.5%	55.3%	74.0%	68.4%	65.6%	484
Manufacture of medical, precision and optical instruments,	33	42.6%	43.8%	41.1%	47.4%	49.9%	1,106
Manufacture of textiles	17	40.4%	41.7%	40.0%	41.6%	48.4%	5,228
Manufacture of fabricated metal products	28	39.3%	39.0%	36.3%	36.9%	42.8%	3,922
Manufacture of electrical machinery and apparatus n.e.c.	31	37.6%	39.6%	35.6%	37.4%	41.6%	4,121
Manufacture of rubber and plastics products	25	37.4%	37.5%	37.1%	33.3%	41.2%	3,383
Manufacture of machinery and equipment n.e.c.	29	34.6%	34.2%	33.4%	35.6%	39.6%	7,871
Manufacture of motor vehicles, trailers and semi-trailers	34	30.4%	29.7%	27.3%	32.7%	34.1%	2,291
Manufacture of chemicals and chemical products	24	23.1%	22.5%	23.8%	24.7%	29.4%	5,545
Manufacture of food products and beverages	15	24.4%	26.2%	24.0%	26.3%	28.3%	5,515
Manufacture of other non-metallic mineral products	26	10.8%	16.4%	19.5%	20.9%	21.9%	4,764
Manufacture of basic metals	27	16.2%	16.8%	17.2%	17.0%	21.6%	4,153
Manufacture of paper and paper products	21	13.7%	15.9%	13.8%	14.1%	18.2%	1,788
Publishing, printing and reproduction of recorded media	22	17.9%	13.9%	11.7%	15.0%	16.0%	857
Manufacture of coke, refined petroleum products and	23	7.7%	6.2%	9.0%	6.5%	10.9%	522
Mining of metal ores	13	0.0%	2.8%	5.9%	4.2%	5.9%	794
Mining of coal and lignite; extraction of peat	10	1.3%	2.0%	3.1%	1.9%	2.8%	1,346
Electricity, gas, steam and hot water supply	40	0.0%	1.0%	1.1%	1.3%	2.0%	1,088

Table 6: Probit Regression on whether the firm is a gazelle (China)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Exporter <sub>t-1</sub>	0.13***	0.15***	0.09***	0.05***	0.03***	0.04***	0.04***		
Exporter <sub>t</sub>								0.06***	0.07***
Ln(Number of Employees)		-0.04***	-0.00	-0.04***	-0.04***	-0.06***	-0.06***	-0.09***	-0.09***
Age			-0.02***	-0.02***	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***
Collective Owned					0.18***	0.14***	0.15***	0.16***	0.17***
Equity Cooperative					0.18***	0.19***	0.20***	0.24***	0.24***
Joint Ownership Enterprises					-0.00	0.05	0.06	0.06*	0.06*
Limited Liability Corporations					0.21***	0.20***	0.23***	0.27***	0.27***
Share-holding corporations ltd					0.23***	0.21***	0.23***	0.27***	0.27***
Private Enterprises					0.34***	0.33***	0.37***	0.40***	0.40***
Other domestic enterprises					0.39***	0.37***	0.38***	0.35***	0.35***
Enterprises with Funds from Hong Kong, Macao					0.20***	0.22***	0.23***	0.26***	0.26***
Foreign Funded Enterprises					0.24***	0.27***	0.29***	0.33***	0.33***
Interaction: exporter and age									-0.00052
Pseudo R <sup>2</sup>	0.0019	0.003	0.0204	0.0385	0.0415	0.0495	0.0573	0.0746	0.0746
Observations	341,977	338,460	338,460	298,830	265,675	265,675	265,675	301,092	301,092
Industry F-Es	X	X	X	✓	✓	✓	✓	✓	✓
Province F-Es	X	X	X	X	X	✓	✓	✓	✓
Year F-Es	X	X	X	X	X	X	✓	✓	✓

Robust standard errors in brackets

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Excluded Category is State-Owned Enterprise

Table 7: Probit Regression on whether the firm is a gazelle (India)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Exporter <sub>t-1</sub>	-0.36***	-0.19***	-0.19***	-0.13***	-0.14***	-0.14***	-0.18***		
Exporter <sub>t</sub>								-0.17***	-0.17***
ln(Starting Year Revenue)		-0.15***	-0.12***	-0.12***	-0.12***	-0.12***	-0.10***	-0.13***	-0.13***
Age			-0.01***	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***
State-Owned Enterprise					-0.14*	-0.12	-0.09	-0.04	-0.04
Private Foreign					0.03	0.04	0.08	0.12**	0.12**
Private Group					0.03	0.04	0.11***	0.11***	0.11***
Interaction									0
Constant	-0.96***	-1.33***	-1.13***	-1.42***	-1.43***	-1.72***	-2.82***	-2.02***	-2.02***
Pseudo R2	0.0162	0.0646	0.0702	0.0842	0.0846	0.0896	0.1509	0.159	0.159
Observations	35,617	35,617	35,617	35,617	35,617	35,464	35,464	42,147	42,147
Industry Fixed Effects	X	X	X	✓	✓	✓	✓	✓	✓
Province Fixed Effects	X	X	X	X	X	✓	✓	✓	✓
Year Fixed Effects	X	X	X	X	X	X	✓	✓	✓

Robust standard errors in brackets

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Excluded Category is private and not within a group of companies. Examples of private group ownership are firms belonging to the Tata and

Table 8: Probit Regression on whether the firm is a gazelle (India) – Manufacturing Only

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Exporter <sub>t-1</sub>	-0.22***	-0.09***	-0.09***	-0.09***	-0.10***	-0.10***	-0.12***		
Exporter <sub>t</sub>								-0.10***	-0.09***
ln(Starting Year Revenue)		-0.12***	-0.12***	-0.12***	-0.12***	-0.12***	-0.13***	-0.16***	-0.16***
Age			0	0	0	0	0	0	0.00017*
State-Owned Enterprise					-0.09	-0.02	-0.01	-0.03	-0.03
Private Foreign					0.07**	0.09***	0.09***	0.08***	0.08***
Private Group					-0.01	-0.04	-0.02	-0.01	-0.01
Interaction									0
Constant	-1.07***	-0.99***	-0.99***	-0.99***	-1.01***	-1.31***	-1.60***	-1.13***	-1.13***
Pseudo R2	0.0064	0.0344	0.0344	0.0344	0.0352	0.0407	0.0571	0.0746	0.0749
Observations	34,482	34,482	34,482	34,482	34,482	34,340	34,340	43,171	43,171
Industry Fixed Effects	X	X	X	✓	✓	✓	✓	✓	✓
Province Fixed Effects	X	X	X	X	X	✓	✓	✓	✓
Year Fixed Effects	X	X	X	X	X	X	✓	✓	✓

Robust standard errors in brackets

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Excluded Category is private and not within a group of companies. Examples of private group ownership are firms belonging to the Tata and

Table 9: Notable Gazillas in China

Corporate Name	Product	Ownership Type	# of periods as a gazelle	Subsidiary of	Revenue 2007 (in million USD)
Hongfujin Precision	Computer and digital camera	Foreign Funded	4	Hon Hai Precision	25,400
Nokia Telecommunications	Mobile phones	Foreign Funded	4	Nokia Corporation	12,900
Huawei Technologies Co.,	Telecommunication	Limited Liability	5		12,600
Baoshan Iron and Steel Co.,	Steel Products	Share-holding	2		12,100
Dafeng Computer	Manufacture of measuring	Foreign Funded	2		8,899
Shanghai General Motors	Cars, engines and	Foreign Funded	4	SAIC Motor	8,898
Shandong	Manufacture of textile	Limited Liability	6		7,643
North China Grid Co., Ltd.	Electric power	Limited Liability	3	State Grid Corporation	6,861
Jiangsu Shagang Group Co.,	Steel Products	Limited Liability	4		6,530
SINOPEC Maoming	Petroleum refinery services	Share-holding	3	China Petroleum &	5,681
Guangzhou Honda	Vehicles and vehicle parts	Foreign Funded	4	GAIG Stock Co., Ltd	5,655
Wanxiang Group	Auto parts	Share-holding	5		5,584
Laiwu Steel Corporation	Manufacture and processing	Limited Liability	4	Jinan Iron & Steel Co.	5,062



Table 10: Notable Gazillas in India (Revenues)

Firm Name	Product	Ownership Type	Highest Rank	Periods as Gazelle	Rank in 2007	2007 Revenue (\$ million, 2000)	Periods as Exporter	Year of Inc.
M M T C Ltd.	Trade in minerals &	Central Govt. -	1	2	6	3744.207	0	1963
Tata Motors Ltd.	Heavy commercial	Tata Group	1	3	3	4876.019	17	1945
Reliance Industries Ltd.	Petroleum products	Reliance Group	1	5	1	18615.54	17	1966
Mangalore Refinery &	Petroleum products	Central Govt. -	2	7	2	5065.931	5	1988
Hindustan Unilever Ltd.	Cosmetics, toiletries,	Uni Lever (F)	2	3	14	2074.573	17	1933
Maruti Suzuki India Ltd.	Passenger cars	Private (Foreign)	2	2	9	2745.922	17	1981
Bharti Airtel Ltd.	Cellular mobile phone	Bharti Telecom	2	3	5	4035.16	0	1995
State Trading Corpn. Of	Wholesale Trade	Central Govt. -	2	3	12	2301.631	0	1956
G A I L (India) Ltd.	LNG storage &	Central Govt. -	3	3	8	2856.675	0	1984
Chennai Petroleum	Petroleum products	Central Govt. -	3	4	4	4628.265	0	1965
Tata Communications	Basic telephone service	Tata Group	4	3	36	852.0295	0	1986
Adani Enterprises Ltd.	Trade in manufactured	Adani Group	7	6	18	1613.658	0	1988
Hindalco Industries Ltd.	Aluminium, unwrought	Birla Aditya	7	4	7	3127.217	17	1958
Tata Consultancy	Computer software	Tata Group	7	3	10	2598.437	0	1995
Brooke Bond Lipton	Tea	Uni Lever (F)	8	2			5	1912
M S T C Ltd.	Trade in minerals &	Central Govt. -	8	3	59	481.4523	0	1964
Rashtriya Ispat Nigam	Finished steel (incl.	Central Govt. -	8	2	22	1441.674	12	1982
Gitanjali Gems Ltd.	Diamonds	Private (Indian)	9	3	78	349.2314	11	1987
Premier Ltd.	Machine tools	Vinod Doshi	9	2	945	14.02531	14	1944
Essar Steel Ltd.	Hot rolled coils, strips,	Essar (Ruia)	10	7	23	1416.299	11	1976
Tata Power Co. Ltd.	Thermal electricity	Tata Group	10	3	38	812.3107	0	1919
Hero Honda Motors Ltd.	Motorcycles	Hero (Munjals)	10	6	16	1845.256	17	1984

Table 11: Manufacturing Gazillas in India (Most Consistent Firms)

Firm Name	Product	Ownership Type	Periods	2007 Revenue (\$	Rank in	Highest	Periods	Year
Infosys	Computer software	Private (Indian)	14	2286.228	13	12	0	1981
Satyam Computer	Computer software	Satyam Computers	10	1082.949	29	27	0	1987
Sterlite Industries	Copper & copper products	Sterlite Inds.	10	1959.418	15	15	11	1975
Ruchi Soya Inds.	Soybean oil	Ruchi Group	9	1351.257	24	19	17	1986
J S W Steel Ltd.	Hot rolled coils, strips, sheets	Om Prakash Jindal	8	1462.341	20	18	6	1994
Idea Cellular Ltd.	Cellular mobile phone service	Birla Aditya Group	8	990.1478	33	25	0	1996
Mangalore	Petroleum products	Central Govt. -	7	5065.931	2	2	5	1988
Essar Steel Ltd.	Hot rolled coils, strips, sheets	Essar (Ruia) Group	7	1416.299	23	10	11	1976
A B B Ltd.	Switchgears, nec	Asea Brown Boveri	6	726.9648	44	20	17	1949
Lloyds Steel Inds.	Hot rolled coils, strips, sheets	Lloyd Steel Group	6	301.0291	99	21	12	1970
Wipro Ltd.	Computer software	WIPRO Group	6	2392.202	11	11	0	1945
Tata Sons Ltd.	Securities and stock traders	Tata Group	6	43.39724	527	13	0	1917
Adani Enterprises	Trade in manufactured	Adani Group	6	1613.658	18	7	0	1988
Sical Logistics Ltd.	Cargo handling	Chidambaram	6	227.0147	133	18	0	1955
Hero Honda	Motorcycles	Hero (Munjals)	6	1845.256	16	10	17	1984
Hindustan	Construction of roads,	Gulabchand Doshi	5	260.8141	114	28	0	1926
Rajesh Exports	Gems & jewellery	Private (Indian)	5	1037.925	30	29	11	1995
P E C Ltd.	Trade in agricultural crops	Central Govt. -	5	724.5649	45	14	0	1971
Ambuja Cements	Cement	Private (Foreign)	5	1103.638	28	28	12	1981
Reliance	Petroleum products	Reliance Group	5	18615.54	1	1	17	1966
Indo Rama	Synthetic textiles	Uniworth (Indo	5	340.568	82	23	15	1986

## Data Appendix

The exporter variable was created so that exporters are listed as such if they have an export delivery value greater than zero for the first year of the gazelle period. Therefore, the lagged exporter variable included in the probit analysis refers to whether a company is flagged as an exporter for the year previous to first year of a gazelle period. Unfortunately export delivery value was only included in the Chinese Survey of Industrial Enterprises in 1999, 2000, 2001, 2002, and 2005. Therefore only the gazelle periods starting in 1999-2002 have a dummy variable indicating whether a firm was an exporter. This constraint also means that all analysis for China that includes an exporter variable, including the probit as well as the overall measure of the percent of exporters that gazelle, only includes data from the gazelle periods starting in 1999-2002.

The probit uses the values for the specified variables in the first year of the period. So the gazelle variable is laid out so that a gazelle in the period 2004-2008 is coded as a gazelle in 2004 in the probit. Therefore the variables used in the regression such as number of employees and age are the values recorded for 2004.

Different years of the Chinese Survey of Industrial Enterprises include different measures of revenue. All years but two, 2004 and 2007, include "product sales revenue." The only revenue available in 2004 was "main business revenue," and in 2007 the only revenue available was "total annual operating revenue." Besides 2004, "main business revenue" was only included in the survey conducted in 2006. Likewise, besides "total annual operating revenue" being the only choice in 2007, it was also included in the surveys of 2000 and 2006. No other measures of revenue were included in the surveys besides those listed above. Since "product sales revenue" was available for six years, as compared to the two years available for "main business revenue" and the three years available for "total annual operating revenue," it was used as our primary source of revenue for the years it was available.

This limitation leads us to use "main business revenue" for 2004 and "total annual operating revenue" for 2007. In order to investigate how this would affect our identification of gazelles, we compared the three revenues from 2006 (the only year they were all listed). "Main business revenue" and "product sales revenue" are identical except for a very few outliers. Therefore our identification of gazelles in periods using data from 2004 (2000- 2004 and 2004-2008), should not be greatly affected by our use of "main business revenue" instead of "product sales revenue."

In 2007, neither "product sales" nor "main business" is available and so we use "total annual operating revenue," which includes all activities of the firm, not just the primary activity. For diversified firms this would constitute a problem since the additional revenue from other activities, not included in the

revenue measure (product sales) the first year, is included for the revenue measure (total annual operating) for the end year. Even if the firm stagnated in the four year period, the addition of the revenue from other activities would make the firm seem more productive, which could possibly lead to it being mislabeled as a gazelle. Thus, the share of gazelles in the final period would be biased upwards. By comparing the “total annual operating revenue” and the “product sales revenue” that we have for the same year, 2006, we can get a sense of the magnitude of this bias.

The distribution of the ratio of “product sales revenue” to “total annual operating revenue” is such that they are virtually identical<sup>9</sup> in 83 percent of the cases, but for approximately 10% of the observations, total annual operating revenue is at least 10% larger. If the distribution of the ratio is similar in 2007, we expect that using “total annual operating revenue” would noticeably bias upward the revenue in a similar share of cases. In order to examine when this bias would make the difference between identifying a firm as a gazelle or not, we used the 2006 “total annual operating revenue” instead of the 2006 “product sales revenue” to identify which firms were gazelles. Instead of the 16.0% of firms that are gazelles that we found when using “product sales revenue,” we identified 16.7% of firms as gazelles when we used “total annual operating revenue.” This is a difference in estimates of percent of firms that are gazelles of 0.7%.

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<sup>9</sup> Total annual operating revenue is at most 1.5% larger than product sales revenue.