European Bank
for Reconstruction and Development

Chaebols and firm dynamics in Korea

Philippe Aghion, Sergei Guriev, Kangchul Jo

Abstract

We study firm dynamics in Korea before and after the 1997-98 Asian crisis and pro-competitive reforms that reduced the dominance of chaebols. We find that in industries that were dominated by chaebols before the crisis, labor productivity and TFP of non-chaebol firms increased markedly after the reforms (relative to other industries). Furthermore, entry of non-chaebol firms increased significantly in all industries after the reform. Finally, after the crisis, non-chaebol firms also significantly increased their patenting activity (relative to non-chaebol firms). These results are in line with a neo-Schumpeterian view of transition from a growth model based on investment in existing technologies to an innovation-based model.

Keywords: Schumpeterian growth, chaebols, Asian crisis

JEL Classification Number: O43, L25

Contact details: Sergei Guriev, One Exchange Square, London EC2A 2JN, United Kingdom

Phone: +44 20 7338 6805; Fax: +44 20 7338 6111; email: gurievs@ebrd.com

Philippe Aghion, College de France and London School of Economics

Phone: +33 1 44 27 17 06; email: p.aghion@lse.ac.uk

Kangchul Jo, London School of Economics

Phone: +44 7477 006402; email: K.Jo1@lse.ac.uk

Sergei Guriev is Chief Economist at the European Bank for Reconstruction and Development, Professor of Economics at the Institut d´´etudes politiques de Paris (Sciences Po) and Research Fellow at the Centre for Economic Policy Research (CEPR). Philippe Aghion is a Professor of Economics at the College de France and London School of Economics. Kangchul Jo is a doctoral student at London School of Economics.

The authors thank seminar and conference participants at EBRD, London School of Economics, and Sciences Po. Financial support from the EBRD Korea Trust Fund is gratefully acknowledged.

Working Paper No. 227 **Prepared in June 2019**

1 Introduction

Developing countries need to rely on different growth models depending on their level of development. The Schumpeterian growth framework (Aghion and Howitt, 1992, Aghion et al., 2014) implies a major distinction between the performance of "investment-based" and "innovation-based" models conditional on the distance to the global productivity frontier. Economies that are far from the productivity frontier can catch up with advanced economies through investment-based model adopting technologies developed elsewhere. This growth model requires substantial capital investments and often involves centralized coordination of investments – by the state or by large business groups. As the economy gets closer to the frontier, it needs to switch to the "innovation-based" model: growth comes from inventing new technologies rather than from importing those invented elsewhere. Innovation-based growth model requires high-skilled workforce, investment in advanced research and development as well as dynamic competitive environment: competition between decentralized firms, their entry and exit.

Switching from the investment-based model to the innovation-based one may be delayed because of the political economy of institutional change. Investment-based model creates powerful interest groups that are keen to preserve status quo and may resist adopting the innovation-based model. In this case, the investment-based model may overstay its welcome – with adverse implications for the productivity growth and economic development. In this case, the economy may end up in a "middle-income trap" (Gill and Kharas 2007).

In this paper, we study firm-level data in Korea to develop a granular understanding of the transition from investment-based to innovation-based model after the 1997-98 crisis that substantially reduced the political influence of incumbent business groups (chaebols). Korea is a quintessential testing ground for the Schumpeterian growth theory. The conventional description of Korea's economic transformation in recent decades includes three key elements (Chang 2003). First, before the 1997-98 Asian crisis Korea relied on the chaebol model. Chaebols' member firms and banks supported each other (through access to subsidized finance, providing explicit and implicit bailout guarantees) and effectively restricted entry of independent firms (and of foreign direct investors). Chaebol-based model did manage to deliver in terms of industrialization, investment and export growth – exactly in line with the Schumpeterian growth framework.[1] Second, the Asian crisis undermined the legitimacy of chaebol model and provided a window of opportunity for reform. At this point, the blueprints for pro-competitive reforms have already been discussed in Korea but it was the crisis that provided a critical impetus for reforms due to the pressure of the IMF. Third, the restructuring of under-performing chaebols and removal of entry barriers and implicit financial support for chaebol members opened up Korean economy for competition. This helped to shift to the post-industrial model based on innovation.[2]

While the narrative above seems to fit macroeconomic trends, it has never been tested using disaggregated data. In this paper, we use the census of Korean manufacturing firms to understand whether the 1998 reforms did indeed result in greater entry of non-chaebol firms and their productivity growth in industries that used to be dominated by chaebols.

---

[1] In 1963-97, Korean GDP per capita has been growing with an average rate of 7 per cent per year making it one of the most impressive economic growth episodes in history.

[2] For example, according to the US Patents and Trademarks Office (USPTO), in 1992, Korea filed 8 times fewer patents applications to the USPTO than Germany; in 2003, the respective ratio was only 1.8 times. Since 2012, Korea has overtaken Germany in terms of US patents applications; in 2015, it has filed 30% more patent applications to the USPTO than Germany (despite having roughly half the population of Germany and less than half of German GDP, either in nominal or PPP terms).

We find – consistent with the conjecture above – that after the crisis the industries previously dominated by chaebols have seen relatively faster growth of productivity (both labor productivity and total factor productivity) of non-chaebol firms. Furthermore, entry of non-chaebol firms increased significantly in all industries after the reform.

Finally, we study the firm-level data on patenting activity. We find that before the crisis chaebol firms had slightly faster growth of patents per year relative to their non-chaebol counterparts. However, after the crisis, annual number of patents by chaebol firms stopped growing – while patenting by non-chaebol firms accelerated. The acceleration of patenting by non-chaebol firms was uniform across all industries.

This evolution in patenting activity is consistent with the dynamics of Korean firms' markups. The markups of non-chaebol firms increased after the crisis in all industries. However, the markups of chaebol firms only increased in industries with lower pre-crisis presence of chaebols. In the industries previously dominated by chaebols, there was no significant change of chaebol firms' markups after the crisis.

The rest of the paper is structured as follows. In Section 2 we discuss related literature. In Section 3 we provide a background discussion of pre-crisis economic institutions in Korea, the role of chaebols and describe the 1998 reforms. In Section 4 we discuss the data and the methodology. In Section 5 we present the main results. Section 6 includes additional results and robustness checks. Section 7 concludes.

2 Literature review

The fact that the 1997-98 crisis and the subsequent IMF-backed reform reduced the chaebols' grip on the Korean economy and thus promoted access to finance, entry, exit and productivity growth has already been documented in the literature – albeit using much smaller datasets. Borensztein and Lee (2002) have shown that before the crisis the chaebol firms had preferential access to credit. After the crisis there was no significant difference between chaebol and non-chaebol firms. This has helped to increase efficiency: while before the crisis credit was not directed to more efficient firms, after the crisis it was. Hong, Lee and Lee (2007) studied the level of investment controlling for cash flows and investment profitability and showed that before the crisis chaebol firms invested more than non-chaebol firms. This difference disappeared after the crisis. Both papers' datasets are limited to listed firms.

Borensztein and Lee (2005) have analyzed both listed and non-listed firms but used aggregated industry-level data for 32 sectors. They also showed that before the reform credit was not likely to be directed towards more efficient sectors – nor that sectors receiving more credit demonstrated higher growth.

Minetti and Yun (2015) use data from KISLINE on 242 firms (including 37 chaebol firms) and 1608 syndicated loans to these firms. They show that before the reforms banks had weaker incentives to monitor their chaebol borrowers (relative to non-chaebol borrowers) than after the reform. They argue that the reform removed the implicit bailout guarantee to chaebols.

The only paper that uses the same Mining and Manufacturing survey that we use is Asturias et al. (2017) – who also utilize similar data for Chile and for the US. They show, both theoretically and empirically, that during the period of fast growth, net entry explains a higher share of growth (thus focusing on the change of aggregate performance change over time). We use the same dataset for Korea but our focus is on the industry-level outcomes, the role of chaebols and the change in competitive environment due to 1998 reforms.

Another relevant paper is Hemous and Olsen (2017) that shows that domination of business groups reduces market size for potential innovators resulting in fewer patents. They use data from the US and Japan where keiretsus are similar to Korean chaebols.

3 Chaebols and the 1998 reforms

Chaebol is a Korean term that refers to a large business group in Korea.[3] Chaebols have played a critical role in the rapid growth of Korean economy, and some of its member firms such as Samsung Electronics and Hyundai Motors have become major global players. Chaebols emerged as Korean businessmen and government developed close ties after World War II. Chaebol founders benefited from the sales of the assets previously held by Japanese owners and from the allocation of foreign currency due to their connections with high-ranking government officials. During the 1960s, the government carried out a series of five-year plans to accelerate economic growth. The government examined the validity of large investment projects and effectively directed the use of the limited amount of foreign loans to projects that can foster export-oriented industries. Many chaebols grew rapidly since they were selected by the government to take on these projects and therefore benefitted from various forms of government support. As real wages increased in 1970s, the government modified the target of its plans to promote the heavy equipment and chemical industries. It continued providing subsidies to chaebol firms in these industries and bailed out failed companies in the aftermath of the oil price shocks. Following the end of 18-year Chung-Hee Park's regime in 1979, the government's support of chaebols became less prominent. But deregulation of financial sector–including privatization of banks and elimination of the limits on ownership of non-bank financial institutions–provided chaebols with opportunities for funding their investments through internal capital markets and cross-subsidization within the groups.

Most of the chaebols diversified their business to unrelated areas, and each of the affiliate firms acted as if it was a subsidiary of the business group, sharing technology, brand, human resources, and capital within the group. Chaebols have formed their internal capital markets and utilized the practices including loans, debt guarantees, and cross-shareholding to facilitate the expansion of their business. At their peak in mid- to late 1990s, the top 30 chaebols accounted for 16 percent of Korean GDP – with top 5 chaebols alone (Hyundai, Samsung, LG, Daewoo and SK) accounting for 10 percent of GDP (Chang, 2003, p. 11).

The mutual debt guarantees and cross-subsidization effectively limited access to finance for non-chaebol members.[4] Chaebols also benefitted from restrictions on foreign ownership which before 1997 was limited to 26% of capital of Korean firms.[5]

The implicit bailout protection provided by the government (Minetti and Yun, 2015), mutual debt guarantees, cross-subsidization and non-transparent corporate governance[6] have however resulted in

[3] Its definition by the Korean Standard Dictionary is 'a group of capitalists and businessmen who manage several firms and own huge wealth'. The word chaebol consists of *chae* ("wealth or finance") and *bol* ("lineage or clique, with a strong connotation of exclusivity", Haggard et al. 2003, p. 25).

[4] The Federal Trade Commission effectively started to police chaebols' anti-competitive practices involving debt guarantees and cross-subsidization only in 1998 (Chang, pp. 127, 222, 237, World Bank, 1999, p. 76). See World Bank (1999, pp. 83-84) for a discussion of the role of chaebols in limiting independent firms' access to finance before the reform.

[5] Haggard et al. (2003, p. 319) refer to the FDI regime in pre-crisis Korea as "one of the most restrictive in Asia" providing firms with substantial protection in the domestic market.

[6] Through cross-shareholding among affiliated firms, families of chaebol founders have practically dominated the entire group although they owned a small portion of shares. This has brought about several problems such as lack of

funding of inefficient activities. Within-group moral hazard has resulted in overinvestment: while chaebols' capital intensity has grown, the productivity of capital has declined in 1990s by a factor of two (Chang 2003, p.18).

Eventually, the accumulation of inefficiencies and mutual debt guarantees amplified the chain reaction of insolvencies and bankruptcies of chaebol affiliates during the 1998 crisis. The number of bankruptcies in Korean economies in 1998 was twice as high as in the previous years (Chang, 2003, p.5); a top-5 chaebol Daewoo went bankrupt in 1999 (OECD, 2000).

In late 1997, the Korean government applied for IMF funds and agreed to implement several important pro-competitive reforms and restructuring of chaebols (IMF, 1997a,b). First, the government forced them to cut their debt-equity ratios to less than 200%, and to eradicate the mutual debt guarantees (Chang, 2003, pp. 190, 195, 213). It also required to improve corporate governance and to consolidate accounts. It has also introduced transparent regulation of financial institutions.

The reform also liberalized entry for foreign investors (lifting the foreign ceiling ownership to 50% by the end of 1997 and to 55% by the end of 1998).

The government also radically strengthened antitrust enforcement, both chaebol regulation and traditional competition policy (Haggard et al. 2003, p. 320). The number of corrective orders issued and amounts of surcharges imposed increased threefold and 25-fold, respectively, in 1998-2000 relative to pre-crisis levels (Shin 2003, p. 277).

All these measures drastically lowered barriers to entry for non-chaebol firms (including foreign-owned[7]) and reduced chaebol firms' preferential access to finance – thus further levelling the playing field for non-chaebol firms.

4 Data and empirical methodology

4.1 Methodology

We employ differences-in-differences as our main methodology. The reforms of chaebol following the Asian crisis offers a perfect quasi-natural experiment for analyzing the dynamics of chaebol firms. The key regressors in our specifications are the share of chaebol firms in industry sales and its interaction with the post-crisis time dummy. The main specification is the following:

$$Y_{it} = \alpha_i + \beta_1 Post\ crisis_t + \beta_2 (Chaebol\ share_i \times Post\ crisis_t) + u_{it}$$

The subscripts *i* and *t* denote each industry and year, respectively. We include industry fixed effects α_i and cluster standard errors at the industry level. Y_{it} refers to the dependent variables of which dynamics we want to look at. We define the *Post crisis* variable as a dummy variable that is 0 for years before 1998, 1 after 1998, and has no value for year 1998. We tried other variations such as including 1998 to either pre or post crisis period; the results did not change. (The results are also robust to replacing the *Post crisis* dummy with individual year fixed effects). For the *Chaebol share* variable we use the average pre-crisis chaebol share in industry sales. As the *Chaebol share* variable is completely absorbed by the industry fixed effects, we only use *Post crisis* dummy and the

accountability by chaebol chairmen, expropriation through inside trading or internal transfer pricing scheme (World Bank, 1999, ch.6).

[7] As shown in Yun (2003), the reforms resulted in dramatic increase in FDI flows – from 0.5% of GDP before the crisis to 2% of GDP already in 1998-2000.

interaction term as regressors. The results were also robust to choosing the lagged chaebol share as the chaebol share variable.

We run main regressions using each dependent variable for all firms, and for chaebol and non-chaebol firms separately. In all regressions we exclude top and bottom 1% firm-level observations in order to make sure that our results are not influenced by outliers.

4.2 Data

Since chaebol is a general term that is used to denote a large business group in Korean, it is crucial to set up a specific criterion for chaebols for a viable analysis. In this paper, we consider the 30 largest business groups of each year based on the total asset values of affiliated firms as 'chaebols.' There are three reasons for considering this standard. First, this is the most widely used one in the Korean literature. Second, these business groups have been usually the ones that were regulated by Korean government.[8] Lastly, in relation to the second point, the information on the names and the list of affiliated firms has been consistently available for these groups during our sample period. Table 1 is the list of 30 largest business groups for each year. Most of the dynamics in and out of the list are primarily due to bankruptcies, mergers and acquisitions.

Some continuing business groups such as Daesang have shown up for some years and disappeared for other years on the list. This fact implies that the same firm could be a chaebol member or not in a certain year depending on the chaebol status of the business group that it belongs to. But the firms that have been a member of 30 largest business groups for the whole sample period took up 54% of sales of the firms that have been a member of 30 largest business groups at least for a year, suggesting that these incumbent chaebol firms showed higher dominance compared to relatively short-lived chaebol firms.

Our main source of plant-level data is annual Mining and Manufacturing Survey implemented by Statistics Korea.[9] The survey covers all plants located in Korea with at least 5 employees, running a business in mining and manufacturing industry according to the KSIC (Korean Standard Industrial Classification).[10] As in 99.9% of the plants in this population have complied with the survey in 1992-2003, we can assume that the observations in the survey are effectively the universe of Korean mining and manufacturing plants. Each observation in the micro data is a plant, which is distinct from a firm in the sense that a firm can have multiple plants. We will keep this distinction until we explain our data collection method and follow the convention of calling the entities in the data 'firms' in later sections. The survey provides a wide range of information on plants' business activities such as number of employees, sales, manufacturing costs, selling and management expenses, and value of tangible assets.

We fix the sample period from 1992 to 2003, as the survey data are available from 1992 and we want to consider periods of the same span before and after the 1997-1998 crisis. To take full advantage of

[8] Fair Trade Commission, which is a department of Korean government, regulates chaebols based on the "Monopoly Regulation and Fair Trade Act". It announces the list of chaebols that are under regulation annually. There have been numerous changes in the criteria for designating chaebols under regulation, but the criteria remained mostly consistent during our sample period (1992-2003) except for the inclusion of public enterprises from 2002. Taking these changes into account, we focus on 30 largest private business groups (excluding public enterprises in 2002 and 2003) based on the total asset value of affiliated firms.

[9] The micro data were accessed using remote access service from the MDIS (Microdata Integrated Service), which is operated by Statistics Korea.

[10] The population has changed to plants with at least 10 employees from 2008 survey, but it was kept to those with at least 5 employees for our sample period.

the rich micro data, we choose to use the industry classification up to 5-digit level, which is the finest level in KSIC. The industry classifications are converted to the 8th KSIC for all years following the concordance by Statistics Korea.[11] We focus on manufacturing plants and ignore mining plants.

In the micro data each plant is identified with its unique plant ID, but totally anonymous. This is a major obstacle to our analysis, because we need to be able to distinguish chaebol affiliated firms in the micro data. Most of the previous research that has analyzed chaebol's behavior circumvents this obstacle by using other non-anonymous but less comprehensive data sets such as KIS VALUE.[12] On the other hand, we overcome the problem by directly trying to identify chaebol firms in our micro data using various sources. To the best of our knowledge, this has never been done; we consider this data collection as one of the most novel aspects of our research.

The basic method that we have used to pinpoint chaebol affiliated manufacturing firms is as follows. First, we start from constructing the list of chaebol members in manufacturing using OPNI from 2001 to 2003 and the past press releases from Fair Trade Commission before 2000.[13] The list contains the name of a firm, the affiliated chaebol group, the year and month when the firm was founded, and the representative industry codes up to 5 digits for each year. These variables are the most basic information in our identification process. For chaebol firms from 2001 to 2003, all the variables necessary for the list are available from OPNI except for the 5-digit KSIC codes. These codes were obtained using DART.[14] For firms which were chaebol affiliates before 2000 but not after 2001, we can only retrieve the names of firms and the affiliated chaebol groups from the press releases from Fair Trade Commission. Thus, we need to collect the data for the date of establishment and the industry classification. Various sources of data including DART, history section of each firm's website, news articles, and basic firm information from online hiring websites have been utilized. We could not find any data for some firms, but the share of these firms was less than 5% of all chaebol members.

In addition, we set up the firm-plant links for chaebol firms from the micro data. Since the survey offers plant IDs for all years and firm IDs from 2002, we can establish firm-plant links for chaebol members in 2002 and 2003. For links before 2001, we check the changes in each chaebol firm's plants using the annual business reports from DART, history section of each firm's website and news articles to modify the links in 2002 and 2003.[15] Exploiting these links allows accommodating both

[11] The industry classifications from 1998 to 2003 are based on the 8th KSIC code and the 6th KSIC code from 1992 to 1997 in the micro data.

[12] KIS VALUE is the Korean data set provided by NICE, which is a firm that specializes in credit ratings for Korean firms. It offers information on private firms that must be audited by external examiners. By the current Korean law, firms whose assets are above 12 billion wons (around 10 million dollars) need to submit audit reports by external examiners. Thus, the coverage of KIS VALUE is much narrower than 'Mining and Manufacturing Survey'.

[13] OPNI (http://groupopni.ftc.go.kr) is the Korean website that provides detailed information on Chaebol affiliated firms, including the name of each firm, the date of establishment, and its 2-digit KSIC (Korean Standard Industrial Classification) code. It is run by Fair Trade Commission. Fair Trade Commission announces the designation of 30 large Chaebols in every April. The press releases contain either the list of every Chaebol firms or changes in affiliated firms within each Chaebol group. The list before 2000 was constructed using these press releases. Past press releases of Korea Fair Trade Commission can be found in KDI (Korea Development Institute) Economic Information Center (http://eiec.kdi.re.kr).

[14] DART (http://dart.fss.or.kr/) is the website operated by the Financial Supervisory Service that offers information on every listed and statutory audited firms in Korea. It shows the date of foundation, detailed industry codes of the goods and services that the firm produces.

[15] Unfortunately, we cannot produce such links for chaebol firms that did not exist in 2002 or 2003 because their firm IDs are unknown. These are mainly the chaebol firms that went out of business, were acquired or merged by other firms

multiple plants and industry classifications that one firm can have, because the survey treats the plants separately if either the locations of plants or the industry classification of products are different.

Along with identifying the firm-plant links, we apply the basic information in the list to the micro data to pin down the chaebol-affiliated plants. We implemented the identification exercise based on the year and month of establishment, industry codes, locations, and sales data. Having identified the chaebol firms in the micro data, we calculate sales shares of chaebols in each industry for each year, by dividing the total sales of chaebol plants by the total sales of all plants.

Table 2 shows the summary statistics of chaebol plants and industries with chaebol plants. Through the identification process, we could eventually pinpoint 2,058 chaebol manufacturing firm-year pairs in the micro data out of 2,620 firm-year pairs in the list that we constructed. The success rate of the identification for the entire sample period was 78.5% and yearly success rates have been constantly above 70%. Chaebol plants have taken up around 0.4% of total number of plants, but their sales shares have amounted to 33.9% in the data, reflecting the strong influence of chaebols in Korean economy. 29% of the KSIC 5-digit industries have had chaebol plants for at least one year during the sample period, and the unweighted mean of chaebol sales share in these industries was 31.2%. Comparison with the chaebol sales share in all industries (33.9%) implies that chaebol plants have primarily operated in industries with larger plants. We should also note that the share of chaebols in industry sales increased before the crisis and declined only slightly after the crisis. Therefore, our results are not driven by major changes in market structure but by the change in conduct.

The main dependent variables in our regressions are productivity (logarithms of industry-level average labor productivity and TFP), entry, exit, employment, capital stock, and growth of capital stock. They are computed for each industry and year. The average labor productivity is defined by total real value added over total number of workers. Since the value added is in nominal terms, we divide it by the GDP deflator for manufacturing. We follow the method of Asturias et al. (2017) to compute TFP of each firm. The only difference with their method is that we use value added rather than gross output. We proxy entry and exit by the market share of entering and exiting plants. They are calculated by dividing the total sales of entering and exiting plants by total sales of all plants. The capital stock of a plant is the average of capital stock at the beginning and the end of each year. The growth of capital stock is the logarithm of the ratio of the current year's value to the previous year's value.

The other important variable in our regressions is the number of patents. We use the Orbis Historical data set provided by Bureau van Dijk. We classify each Korean firm as chaebol affiliates and non-chaebol firms based on our previous list of chaebol firms and count the number of patents for chaebols and non-chaebols by the publication dates. We aggregate the number of patents for all, chaebol, and non-chaebol firms by each year and industry. Since majority of the patents are owned by Korean firms that represent their industry classification by the US SIC (Standard Industrial Classification), we define industries by the ISIC Rev. 4, which is also used in the construction of firm-level dependence on external finance in later sections.[16] We assume that the current owner of each patent was the one that was engaged in research for the patent at the time of publication. Effectively what we use in our regressions is the logarithm of the number of new patents that were published each year for all, chaebol, and non-chaebol firms.

---

before 2001. For these firms, we can identify at most one plant per firm using the basic information although it is possible that they owned multiple plants.

[16] 73.6% of the patents are owned by firms that represent their industry classification by the US SIC during our sample period. The rest are owned by firms whose main industry classification is the 9th KSIC.

To calculate plant-level markups used in Chapter 5.3 we rely on the methodology of De Loecker and Warzynski (2012). Their method requires estimates of the production function to obtain markups, and we consider three models; Cobb-Douglas production function, Cobb-Douglas production function with endogenous productivity process, and translog production function with endogenous productivity process. We use a plant's chaebol membership as a variable affecting optimal input demand. The industry-level markups are the mean of plant-level markups in each industry.

The summary statistics for the above variables are provided in Table 3. The table shows means and standard deviations of industry level variables in industries where the values of these variables are non-missing. Most of the variables have increased after the crisis except for the employment and the growth of capital stock.

5 Main results

5.1 Entry, exit, productivity growth.

Tables 4-9 present our main results. In each table we consider the results for the whole sample (column 1), then for the subsample of chaebol firms (column 2), then for the subsample of non-chaebol firms in industries with non-trivial presence of chaebols (column 3), and the subsample for the non-chaebol firms in the industries with zero chaebol presence (column 4).

In Table 4 we consider the change in labor productivity. Labor productivity growth is faster in all industries after the crisis, and for both, chaebol and non-chaebol firms. In industries with higher presence of chaebol before the crisis, there is a stronger acceleration of labor productivity growth than in non-chaebol dominated industries (both for chaebol and non-chaebol firms).

In Table 5, we consider the change in TFP. While the increase in firms' labor productivity growth after the crisis was greater in chaebol dominated industries for both, chaebol and non-chaebol firms, the increase in TFP after the crisis is larger for non-chaebol firms in (previously) chaebol-dominated industries: the reforms of these industries did open up additional opportunities for non-chaebol firms. This is consistent with the view that Korean economy shifted from investment-based to innovation-based growth model and that chaebol firms reacted to the crisis by increasing capital per worker but without innovating. This intuition will be confirmed by our patent results below.

The magnitudes of the effects are important. Once again, as the average *Chaebol share* before the crisis was 0.32, the post-crisis increase in TFP of non-chaebol firms would be 15 percentage points higher in industries that originally had chaebol presence (0.465*0.32=0.15).[17] This implies that the non-chaebol firms in industries affected by the 1998 competitive reforms had TFP growth twice as fast as those in the industries which initially had no chaebol presence (and therefore were not directly affected). In Figure 1, we show that the results are not driven by pre-trends.

In Table 6 we consider entry before versus after the crisis. We see a substantial increase in entry after the crisis, mainly driven by non-chaebol firms – and weaker in chaebol-dominated industries. The magnitudes are substantial. Given that the average *Chaebol share* is around 0.34, the industries with chaebol presence have 2 percentage point less entry after the crisis (which amounts to about a quarter of all entry and all exit, respectively).

[17] The comparison is similar if we compare the industries with a one standard deviation difference in *Chaebol share.* The within-year standard deviation of *Chaebol share* in our dataset is very stable across the years ranging from 0.24 to 0.28; the average within-year standard deviation is 0.26 both before and after the crisis. The magnitude of the effect is therefore 0.465*0.26=0.12.

In Table 7 we see that exit also increased after the crisis, but this mainly concerns non-chaebol firms in industries not dominated by the chaebols before the crisis. In Tables 8 and 9 we compare the evolution of employment and capital stock (as well as capital investment proxied by the change in capital stock) between before and after the crisis. We find substantial reallocation of both capital and labor after the crisis from chaebol to non-chaebol firms in industries previously dominated by chaebols.

5.2 Patents

In addition to the analysis of productivity, we also study patenting by firms. The results are presented in Table 10. The sample is much smaller due to a different industry classification and to the fact that only 128 industries have non-trivial patenting activity (including only 97 industries with non-trivial pre-crisis chaebol presence). In these industries, patenting activity has been growing steadily both before and after the crisis (Figure 2). This implies the need to control for a linear time trend.

Table 10 presents the results controlling for the linear time trend, the post crisis dummy and the interaction of the dummy with the trend. This specification allows identifying both the jump in patenting activity after the crisis and the change in differences in time trends of patenting activity before and after the crisis. We find that for the whole sample of firms, the linear trend is positive and significant. However, we find a positive shift: after the crisis, the firms on average patent twice as much as after the crisis (exp(0.77)=2.2).

As the second, third and fourth columns show, the results for the whole sample mask an important heterogeneity between chaebol and non-chaebol firms. Before the crisis, chaebol firms had a slightly faster growth of patenting activity over time than their non-chaebol counterparts (9 percent vs. 8 percent per year, respectively). However, after the crisis the situation has changed. Chaebol firms' patenting growth after the crisis slowed down to zero. Also, for the chaebol firms there is no upward shift after the crisis (the coefficient at the Post Crisis dummy is very small and is not significantly different from zero).

On the contrary, the results for the non-chaebol firms show both upward shift and a positive change in the slope of the time trend. The slope of the time trend increases from 8 percent per year before the crisis to 19 percent per year after the crisis; the difference is statistically significant. There is also a 2.5-fold jump in the level of patenting activity of non-chaebol firms after the crisis (the coefficient at the Post Crisis dummy ranges from 0.85 to 0.95; exp(0.9)=2.5).

In Table 11, we examine the heterogeneity of these results with regard to the share of chaebol firms in the industry before the crisis. We add an interaction of the Chaebol share with the linear time trend, with the post crisis dummy, and the triple interaction of the Chaebol share with the dummy and the trend. For the non-chaebol firms, the coefficients at the interactions of Chaebol share with the post crisis dummy and the triple interaction are positive (thus in line with the conjecture that the results are stronger in industries previously dominated by chaebols); they are however not significant, likely due to a small sample size. There are however interesting findings for the chaebol firms (and therefore for the whole sample). Before the crisis was a faster growth of patenting activity by chaebol firms in industries dominated by chaebols (the coefficient at the interaction of Chaebol share with time trend is positive and statistically significant). However, after the crisis this effect was actually fully reversed: the coefficient at the triple interaction is negative, significant and larger in magnitude than the coefficient before the crisis. Therefore after the crisis, chaebol firms in industries previously dominated by chaebols had slower growth in patenting activity than before the crisis.

5.3 Markups

We have followed De Loecker & Warzynski (2012) methodology to calculate firm-level markups. We use three models: Cobb-Douglas production function, Cobb-Douglas production function with endogenous productivity process, and translog production function with endogenous productivity process. Our preferred specification is the one using Cobb-Douglas production function with endogenous productivity process – as we assume Cobb-Douglas production function elsewhere. The results from the other two specifications are similar.

In Figure 3 we show the time trends for markups for chaebol and non-chaebol firms in industries with pre-crisis chaebol share above and below its median. These graphs show that all Korean manufacturing industries had very high markups (ranging from 2 to 6).[18] Second, the chaebol firms had much higher markups (both before and after the crisis) than their non-chaebol counterparts. Finally – consistent with our story – the markups were increasing before the crisis but started to decrease after the crisis.

Table 12 presents the regression results, separately for chaebol and non-chaebol firms. We find that both chaebol and non-chaebol firms increased their markups after the crisis. However, the increase in markups of chaebol firms was different in industries with higher pre-crisis chaebol share and other industries. The increase in markups of chaebol firms was fully explained by industries less dominated by chaebol firms before the crisis (which were less affected by reforms). In the industries previously dominated by chaebols, the increase in markups for chaebol firms was not statistically different from zero, whereas the increase in markups of non-chaebol firms was positive and significant in all industries; there is no difference between the increase in markups between industries with high and low chaebol presence.

Why did markups increase after the crisis in the non-chaebol firms? The first potential explanation could be a survivor bias – the firms with high markups may be more likely to survive the crisis. In Table 13 we present results separately for the panel of surviving firms. If the increase in markup were fully due to the survivor bias, we should have observed zero increase of markups for surviving firms. This is not what we find in Table 13. While coefficients are smaller (so there is certain survivor bias), they are still qualitatively similar to those in Table 12. Therefore, the crisis has indeed resulted in higher markups for surviving firms (except for chaebol firms in industries previously dominated by chaebols; these industries were more affected by the 1998 anti-chaebol reforms).

The other explanation for the evolution of markups in non-chaebol firms, is the innovation activity of these firms. As shown in the previous section, the non-chaebol firms increased patenting after the crisis in all industries – which is consistent with post-crisis increase in their markup. At the same time, patenting activity of chaebol firms was strikingly different in industries previously dominated by chaebols and other industries – also in line with the evolution of their markups.

6. Conclusion

In this paper we analyzed firm dynamics in Korea before and after the 1997-98 Asian crisis and pro-competitive reforms that reduced the dominance of chaebols. We found that in industries that were dominated by chaebols before the crisis, labor productivity and TFP of non-chaebol firms increased markedly after the reforms (relative to other industries). However while labor productivity increased

[18] Markups are generally higher in industries with lower chaebol share. The cross-industry comparison of markup levels is not very informative as it is driven by the differences in the industry-specific ratios in fixed vs. variable costs. In all regressions we control for industry dummies.

for both, chaebol and non-chaebol firms and to similar extent, the increase in TFP after the crisis was larger for non-chaebol firms in (previously) chaebol-dominated industries.

Furthermore, we found that entry of non-chaebol firms increased significantly in all industries after the reform. Finally, after the crisis, the non-chaebol firms also significantly increased their patenting activity (relative to non-chaebol firms). These results are in line with a neo-Schumpeterian view of a transition from investment-based growth to more innovation-based growth as the crisis weakened chaebols' power.

References

Aghion P, Howitt P. (1992) "A Model of Growth through Creative Destruction," Econometrica 60(2), 323-351.

Aghion, Philippe, Ufuk Akcigit, and Peter Howitt. 2014. "What Do We Learn From Schumpeterian Growth Theory?" In Handbook of Economic Growth. Edited by P. Aghion and S. Durlauf. Vol. 2, 515-563. Amsterdam, Elsevier.

Asturias, Jose, Sewon Hur, Timothy J. Kehoe, Kim J. Ruhl (2017) "Firm Entry and Exit and Aggregate Growth." NBER Working Paper 23202.

Borensztein, Eduardo, and Jong-Wha Lee (2005) "Financial reform and the efficiency of credit allocation in Korea." Journal of Policy Reform 8:1, 55-68.

Borensztein, Eduardo, and Jong-Wha Lee (2002) "Financial crisis and credit crunch in Korea: evidence from firm-level data." Journal of Monetary Economics 49: 853–875.

Chang, Sea-Jin (2003). Financial Crisis and Transformation of Korean Business Groups. Cambridge University Press.

De Loecker, Jan and Frederic Warzynski (2012). "Markups and Firm-Level Export Status." American Economic Review 102(6): 2437–2471.

Eeckhout, Jan and Jan De Loecker (2018). "Global Market Power." CEPR Discussion Paper 13009.

Gill, Indermit, and Homi Kharas. 2007. "An East Asian Renaissance: Ideas for Economic Growth." World Bank, Washington, DC.

Haggard, Stephen, Wonhyuk Lim, and Euysung Kim (2003). Economic Crisis and Corporate Restructuring in Korea: Reforming the Chaebol. Cambridge University Press.

Hahn, C. (2000), "Entry, Exit, and Aggregate Productivity Growth: Micro Evidence on Korean Manufacturing", OECD Economics Department Working Papers, No. 272, OECD Publishing, Paris.

Hemous, David, and Morten Olsen (2018). "Long-Term Relationships: Static Gains and Dynamic Inefficiencies." Journal of the European Economic Association 16(2): 383–435.

Hong, Kiseok, Jong-Wha Lee, and Young Soo Lee (2007). "Investment by Korean conglomerates before and after the crisis." Japan and the World Economy 19: 347–373.

IMF (1997a). "Republic of Korea – IMF Standby Agreement: Summary of Economic Program." International Monetary Fund Press-Release, December 5, 1997.

IMF (1997b). Press Conference of Stanley Fischer. International Monetary Fund Press-Release, December 5, 1997.

Kim, Minho, Jiyoon Oh, and Yongseok Shin (2017). "Misallocation and Manufacturing TFP in Korea, 1982-2007" Federal Reserve Bank of St. Louis Review 99(2), pp. 233-44.

Klette, Tor Jakob and Samuel Kortum (2004) "Innovating Firms and Aggregate Innovation." Journal of Political Economy, Vol. 112, No. 5, pp. 986-1018

Lane, Nathaniel (2017) "Manufacturing Revolutions. Industrial Policy and Networks in South Korea." Mimeo, Monash University.

Minetti, Raoul and Sung-Guan Yun, 2015. "Institutions, Bailout Policies, and Bank Loan Contracting: Evidence from Korean Chaebols," Review of Finance, European Finance Association, vol. 19(6), pages 2223-2275.

OECD (2000). OECD Economic Surveys: Korea. OECD Publishing, Paris.

Rajan, R., Servaes, H., Zingales, L., 2000. “The cost of diversity: The diversification discount and inefficient investment.” Journal of Finance 55, 35-80.

Rajan, R., Zingales, L. (1998) “Financial Dependence and Growth.” American Economic Review, Vol. 88, No. 3, pp. 559-86.

Shin, Kwangshik (2003). “Competition Law and Policy.” In Haggard, S., Lim, W. and Kim, E., eds, Economic Crisis and Corporate Restructuring in Korea: Reforming the Chaebol. Cambridge University Press.

Wei, Shang-Jin, Zhuan Xie, and Xiaobo Zhang (2017). “From “Made in China” to “Innovated in China”: Necessity, Prospect, and Challenges.” Journal of Economic Perspectives 31(1), pp. 49-70.

World Bank (1999) “Republic of Korea: Establishing a New Foundation for Sustained Growth.” World Bank Report No. 19595 KO. Washington, DC.

Yun, Mikyung (2003). “Foreign Direct Investment and Corporate Restructuring After the Crisis.” In Haggard, S., Lim, W. and Kim, E., eds, Economic Crisis and Corporate Restructuring in Korea: Reforming the Chaebol. Cambridge University Press.

Tables

Table 1. List of 30 largest business groups (chaebol groups) from 1992 to 2003.

Rank	1992	1993	1994	1995	1996	1997
1	Hyundai	Hyundai	Hyundai	Hyundai	Hyundai	Hyundai
2	Daewoo	Samsung	Daewoo	Samsung	Samsung	Samsung
3	Samsung	Daewoo	Samsung	Daewoo	LG	LG
4	LG	LG	LG	LG	Daewoo	Daewoo
5	Ssangyong	SK	SK	SK	SK	SK
6	Hanjin	Hanjin	Hanjin	Ssangyong	Ssangyong	Ssangyong
7	SK	Ssangyong	Ssangyong	Hanjin	Hanjin	Hanjin
8	Hanwha	Kia	Kia	Kia	Kia	Kia
9	Daelim	Hanwha	Hanwha	Hanwha	Hanwha	Hanwha
10	Lotte	Lotte	Lotte	Lotte	Lotte	Lotte
11	Donga	Kumho	Kumho	Kumho	Kumho	Kumho
12	Hanil	Daelim	Daelim	Doosan	Doosan	Halla
13	Kia	Doosan	Doosan	Daelim	Daelim	Donga
14	Doosan	Donga	Donga	Donga	Hanbo	Doosan
15	Pan Ocean	Hanil	Hyosung	Halla	Donga	Daelim
16	Hyosung	Hyosung	Hanil	Dongkuk Steel	Halla	Hansol
17	Dongkuk Steel	Dongkuk Steel	Halla	Hyosung	Hyosung	Hyosung
18	Sammi	Sammi	Dongkuk Steel	Hanbo	Dongkuk Steel	Dongkuk Steel
19	Hanyang	Halla	Sammi	Tongyang	Jinro	Jinro
20	Kukdong Engineering & Construction	Hanyang	Tongyang	Hanil	Kolon	Kolon
21	Kolon	Tongyang	Kolon	Kolon	Tongyang	Kohap
22	Kumho	Kolon	Jinro	Kohap	Hansol	Dongbu
23	Dongbu	Jinro	Kohap	Jinro	Dongbu	Tongyang
24	Kohap	Dongbu	Woosung Construction	Haitai	Kohap	Haitai
25	Hanbo	Kohap	Dongbu	Sammi	Haitai	Newcore
26	Haitai	Kukdong Engineering & Construction	Haitai	Dongbu	Sammi	Anam
27	Daesang	Woosung Construction	Kukdong Engineering & Construction	Woosung Construction	Hanil	Hanil
28	Samwhan Corporation	Haitai	Hanbo	Kukdong Engineering & Construction	Kukdong Engineering & Construction	Keopyung
29	Halla	Byuksan	Daesang	Byuksan	Newcore	Daesang
30	Woosung Construction	Daesang	Byuksan	Daesang	Byuksan	Shinho

(continued)

Rank	1998	1999	2000	2001	2002	2003
1	Hyundai	Hyundai	Hyundai	Samsung	Samsung	Samsung
2	Samsung	Daewoo	Samsung	Hyundai	LG	LG
3	Daewoo	Samsung	LG	LG	SK	SK
4	LG	LG	SK	SK	Hyundai Motors	Hyundai Motors
5	SK	SK	Hanjin	Hyundai Motors	Hanjin	KT
6	Hanjin	Hanjin	Lotte	Hanjin	POSCO	Hanjin
7	Ssangyong	Ssangyong	Daewoo	POSCO	Lotte	Lotte
8	Hanwha	Hanwha	Kumho	Lotte	Hyundai	POSCO
9	Kumho	Kumho	Hanwha	Kumho	Kumho	Hanwha
10	Donga	Lotte	Ssangyong	Hanwha	Hyundai Heavy Industries	Hyundai Heavy Industries
11	Lotte	Donga	Hansol	Doosan	Hanwha	Hyundai
12	Halla	Hansol	Doosan	Ssangyong	Doosan	Kumho
13	Daelim	Doosan	Hyundai Oilbank	Hyundai Oilbank	Dongbu	Doosan
14	Doosan	Daelim	Donga	Hansol	Hyundai Oilbank	Dongbu
15	Hansol	Dongkuk Steel	Dongkuk Steel	Dongbu	Hyosung	Hyosung
16	Hyosung	Dongbu	Hyosung	Daelim	Daelim	Shinsegae
17	Kohap	Halla	Daelim	Tongyang	Kolon	Daelim
18	Kolon	Kohap	S-Oil	Hyosung	CJ	CJ
19	Dongkuk Steel	Hyosung	Dongbu	CJ	Dongkuk Steel	Tongyang
20	Dongbu	Kolon	Kolon	Kolon	Hanaro Telecom	Kolon
21	Anam	Tongyang	Tongyang	Dongkuk Steel	Hansol	KT&G
22	Jinro	Jinro	Kohap	Hyundai Development Company	Shinsegae	Hanaro Telecom
23	Tongyang	Anam	CJ	Hanaro Telecom	Tongyang	Dongkuk Steel
24	Haitai	Haitai	Daewoo Electronics	Shinsegae	Hyundai Department Store	Hyundai Department Store
25	Shinho	Saehan	Hyundai Development Company	Youngpoong	Hyundai Development Company	Hansol
26	Daesang	Kangwon Industries	Anam	Hyundai Department Store	Youngpoong	Daewoo Shipbuilding & Marine Engineering
27	Newcore	Daesang	Saehan	Oriental Chemical Industries	Daesang	Daewoo Motors
28	Keopyung	CJ	Jinro	Daewoo Electronics	Dongwon	Hyundai Development Company
29	Kangwon Industries	Shinho	Shinsegae	Taekwang Industry	Taekwang Industry	Youngpoong
30	Saehan	Samyang	Youngpoong	Kohap	KCC	KCC

Notes: Rankings are based on the total asset values of affiliated firms. The list is based on the current names of chaebols. For example, LG has been known as Lucky Goldstar before 1994, and SK was known as Sunkyung before 1997. From 2002, public enterprises were included in the designation of large business groups by Fair Trade Commission. This list excludes public enterprises. Some chaebols were divided into several groups sharing the common name primarily due to the inheritance to the founder's offspring. For example, Hyundai Motors, Hyundai Oilbank, Hyundai Development Company, and Hyundai Department Store were separated from Hyundai after the death of its founder, Ju-Young Chung in 2001.

Source: Korea Federal Trade Commission

Table 2. Summary statistics of chaebol plants and industries with chaebol plants.

	1992-2003	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Chaebol firms and plants													
- Number of chaebol firms	2,620	229	238	233	232	236	279	269	239	163	178	162	162
- Number of chaebol firms identified in the micro data (% of total number of chaebol firms)	2,058 (78.5)	179 (78.2)	189 (79.4)	185 (79.4)	185 (79.7)	184 (78.0)	212 (76.0)	200 (74.3)	186 (77.8)	136 (83.4)	142 (79.8)	131 (80.9)	129 (79.6)
- Number of chaebol plants identified in the micro data (% of total number of plants in the micro data)	4,455 (0.39)	269 (0.35)	309 (0.34)	315 (0.34)	342 (0.35)	375 (0.38)	427 (0.46)	424 (0.53)	459 (0.50)	346 (0.35)	391 (0.37)	408 (0.37)	390 (0.34)
- Sales share of chaebol plants in all industries (%)	33.9	27.5	28.8	29.7	31.8	32.3	35.4	35.9	37.6	34.8	35.5	34.2	34.6
Industries with chaebol plants													
- Share of industries with chaebol plants (%)	29.0	22.9	24.8	26.5	26.7	29.4	30.7	29.6	31.4	28.2	30.9	34.2	32.6
- Mean of chaebol sales share in industries with chaebol plants (%)	31.2	32.1	32.2	33.8	34.4	31.5	32.7	31.6	30.9	29.8	29.7	28.5	28.9

Note: Industries are defined by the 8th KSIC, up to 5-digit.

Source: Authors' own calculation based on the data from OPNI, Fair Trade Commission, Mining and Manufacturing Survey, and various other data sources

Table 3. Summary statistics for selected variables in each industry level.

	Mean						Standard deviation					
	All plants		Chaebol plants		Non-chaebol plants		All plants		Chaebol plants		Non-chaebol plants	
	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis
log (Labor productivity)	3.849	4.220	4.626	5.206	3.801	4.154	0.515	0.569	0.710	0.781	0.480	0.501
log (TFP)	5.797	5.999	8.445	8.604	5.711	5.918	0.972	0.978	1.483	1.546	0.868	0.883
Share of entering plants	0.119	0.184	0.003	0.008	0.119	0.180	0.114	0.154	0.021	0.036	0.111	0.147
Share of exiting plants	0.099	0.191	0.001	0.007	0.105	0.185	0.105	0.160	0.012	0.033	0.105	0.155
log (Employment)	7.891	7.831	6.567	6.046	7.787	7.736	1.308	1.311	1.575	1.701	1.301	1.321
log (Capital stock)	11.566	11.911	11.393	11.496	11.396	11.727	1.505	1.533	1.859	1.932	1.418	1.464
Growth of capital stock	0.085	0.033	0.083	-0.018	0.084	0.038	0.104	0.087	0.175	0.143	0.106	0.089
log (Number of new patents)	2.001	3.631	0.793	1.159	1.624	3.308	1.827	1.995	1.738	2.262	1.506	1.765
Markups (Model 2)	2.485	2.704	4.025	4.594	2.454	2.640	1.052	1.191	2.653	3.025	1.024	1.129

Notes: Mean and standard deviation were calculated after excluding top and bottom 1% of each variable for the whole sample period, except for the log of total number of new patents. Industries are defined by the 8th KSIC, up to 5-digit, except for the log of total number of new patents where industries are defined by the ISIC Rev 4., up to 4-digit. Log of total number of new patents is calculated by log (1+Total number of new patents) to accommodate the 0's.

Source: Authors' own calculation based on the data from Mining and Manufacturing Survey and the Orbis Historical.

Table 4. Firm dynamics: Labor Productivity.

Dependent variable: log (Average labor productivity)				
	All firms	Chaebol firms	Non-chaebol firms in industries with non-trivial chaebol share	Non-chaebol firms in industries with zero chaebol share
Post Crisis	0.373*** (0.011)	0.539*** (0.067)	0.355*** (0.017)	0.347*** (0.014)
Post crisis × Average Chaebol share in the industry before the crisis	0.292*** (0.080)	0.301* (0.153)	0.300*** (0.093)	–
# of Observations	5,080	1,463	2,438	2,639
# of Industries	471	226	227	245

Notes: The regressions were run after excluding top and bottom 1% of each dependent variable for the whole sample period. Industries are defined by the 8th KSIC, up to 5-digit. Industry fixed effects and the constant term are included in the regressions. ***, **, and * represent that coefficients are statistically significant at 1%, 5%, and 10 % level, respectively. Standard errors are clustered in each industry level and given in parentheses. The regressions for the second and third columns use industries that showed non-trivial Chaebol shares during the sample period (1992-2003), and the regression for the fourth column use industries that showed zero Chaebol shares during the sample period.

Table 5. Firm dynamics: TFP.

Dependent variable: log (Total Factor Productivity)				
	All firms	Chaebol firms	Non-chaebol firms in industries with non-trivial chaebol share	Non-chaebol firms in industries with zero chaebol share
Post Crisis	0.214*** (0.017)	0.366*** (0.096)	0.153*** (0.027)	0.200*** (0.021)
Post crisis × Average Chaebol share in the industry before the crisis	0.176 (0.167)	-0.162 (0.246)	0.465*** (0.171)	–
# of Observations	5,081	1,464	2,458	2,622
# of Industries	469	224	227	243

Notes: The regressions were run after excluding top and bottom 1% of each dependent variable for the whole sample period. Industries are defined by the 8th KSIC, up to 5-digit. Industry fixed effects and the constant term are included in the regressions. ***, **, and * represent that coefficients are statistically significant at 1%, 5%, and 10 % level, respectively. Standard errors are clustered in each industry level and given in parentheses. The regressions for the second and third columns use industries that showed non-trivial Chaebol shares during the sample period (1992-2003), and the regression for the fourth column use industries that showed zero Chaebol shares during the sample period.

Table 6. Firm dynamics: Entry.

Dependent variable: Share of entering firms				
	All firms	Chaebol firms	Non-chaebol firms in industries with non-trivial chaebol share	Non-chaebol firms in industries with zero chaebol share
Post Crisis	0.071*** (0.005)	0.006*** (0.001)	0.054*** (0.006)	0.071*** (0.006)
Post crisis × Average Chaebol share in the industry before the crisis	-0.060*** (0.020)	-0.008 (0.006)	-0.023 (0.019)	–
# of Observations	4,662	2,244	2,257	2,314
# of Industries	473	227	227	245

Notes: The regressions were run after excluding top and bottom 1% of each dependent variable for the whole sample period. Industries are defined by the 8th KSIC, up to 5-digit. Industry fixed effects and the constant term are included in the regressions. ***, **, and * represent that coefficients are statistically significant at 1%, 5%, and 10 % level, respectively. Standard errors are clustered in each industry level and given in parentheses. The regressions for the second and third columns use industries that showed non-trivial Chaebol shares during the sample period (1992-2003), and the regression for the fourth column use industries that showed zero Chaebol shares during the sample period.

Table 7. Firm dynamics: Exit.

Dependent variable: Share of exiting firms				
	All firms	Chaebol firms	Non-chaebol firms in industries with non-trivial chaebol share	Non-chaebol firms in industries with zero chaebol share
Post Crisis	0.099*** (0.006)	0.006*** (0.002)	0.074*** (0.008)	0.094*** (0.007)
Post crisis × Average Chaebol share in the industry before the crisis	-0.071*** (0.022)	0.003 (0.005)	-0.061*** (0.019)	–
# of Observations	4,678	2,250	2,264	2,227
# of Industries	473	227	227	245

Notes: The regressions were run after excluding top and bottom 1% of each dependent variable for the whole sample period. Industries are defined by the 8th KSIC, up to 5-digit. Industry fixed effects and the constant term are included in the regressions. ***, **, and * represent that coefficients are statistically significant at 1%, 5%, and 10 % level, respectively. Standard errors are clustered in each industry level and given in parentheses. The regressions for the second and third columns use industries that showed non-trivial Chaebol shares during the sample period (1992-2003), and the regression for the fourth column use industries that showed zero Chaebol shares during the sample period.

Table 8. Firm dynamics: Employment.

Dependent variable: log (Employment)				
	All firms	Chaebol firms	Non-chaebol firms in industries with non-trivial chaebol share	Non-chaebol firms in industries with zero chaebol share
Post Crisis	-0.088*** (0.024)	-0.081 (0.126)	-0.129*** (0.037)	-0.128*** (0.034)
Post crisis × Average Chaebol share in the industry before the crisis	-0.096 (0.147)	-0.692** (0.312)	0.458** (0.215)	—
# of Observations	5,078	1,477	2,449	2,626
# of Industries	471	222	226	245

Notes: The regressions were run after excluding top and bottom 1% of each dependent variable for the whole sample period. Industries are defined by the 8th KSIC, up to 5-digit. Industry fixed effects and the constant term are included in the regressions. ***, **, and * represent that coefficients are statistically significant at 1%, 5%, and 10 % level, respectively. Standard errors are clustered in each industry level and given in parentheses. The regressions for the second and third columns use industries that showed non-trivial Chaebol shares during the sample period (1992-2003), and the regression for the fourth column use industries that showed zero Chaebol shares during the sample period.

Table 9. Firm dynamics: Capital.

Dependent variable: log (Capital stock)				
	All firms	Chaebol firms	Non-chaebol firms in industries with non-trivial chaebol share	Non-chaebol firms in industries with zero chaebol share
Post Crisis	0.339***	0.550***	0.333***	0.233***
	(0.028)	(0.143)	(0.041)	(0.035)
Post crisis × Average Chaebol share in the industry before the crisis	0.139	-0.556	0.567**	–
	(0.208)	(0.368)	(0.220)	
# of Observations	5,081	1,472	2,428	2,648
# of Industries	472	224	226	246
Dependent variable: Growth of capital stock				
Post Crisis	-0.043***	-0.088***	-0.061***	-0.033***
	(0.003)	(0.016)	(0.005)	(0.004)
Post crisis × Average Chaebol share in the industry before the crisis	-0.015***	-0.072**	-0.007	–
	(0.016)	(0.032)	(0.020)	
# of Observations	5,085	1,453	2,446	2,635
# of Industries	473	222	227	246

Notes: The regressions were run after excluding top and bottom 1% of each dependent variable for the whole sample period. Industries are defined by the 8th KSIC, up to 5-digit. Industry fixed effects and the constant term are included in the regressions. ***, **, and * represent that coefficients are statistically significant at 1%, 5%, and 10 % level, respectively. Standard errors are clustered in each industry level and given in parentheses. The regressions for the second and third columns use industries that showed non-trivial Chaebol shares during the sample period (1992-2003), and the regression for the fourth column use industries that showed zero Chaebol shares during the sample period.

Table 10. Firm dynamics: Patents.

Dependent variable: log (Number of new patents)				
	All firms	Chaebol firms	Non-chaebol firms in industries with non-trivial chaebol share	Non-chaebol firms including industries with zero chaebol share
Post Crisis	0.772***	0.096	0.954***	0.852***
	(0.081)	(0.117)	(0.093)	(0.082)
Trend	0.114***	0.094***	0.078***	0.077***
	(0.017)	(0.022)	(0.019)	(0.016)
Trend × Post crisis	0.037	-0.087**	0.115***	0.108***
	(0.029)	(0.043)	(0.032)	(0.028)
# of Observations	1,406	1,067	1,067	1,406
# of Industries	128	97	97	128

Notes: Industries are defined by the ISIC Rev. 4, up to 4-digit. Industry fixed effects and the constant term are included in the regressions. ***, **, and * represent that coefficients are statistically significant at 1%, 5%, and 10 % level, respectively. Standard errors are clustered in each industry level and given in parentheses. Trend = Year – 1998.

Table 11. Firm dynamics: Patents controlling for pre-crisis chaebol share.

Dependent variable: log (Number of new patents)				
	All firms	Chaebol firms	Non-chaebol firms in industries with non-trivial chaebol share	Non-chaebol firms including industries with zero chaebol share
Post Crisis	0.775***	-0.032	0.930***	0.789***
	(0.098)	(0.108)	(0.125)	(0.101)
Trend	0.082***	0.016	0.085***	0.081***
	(0.018)	(0.017)	(0.024)	(0.018)
Trend × Post crisis	0.088***	0.039	0.076*	0.079**
	(0.032)	(0.037)	(0.040)	(0.032)
Post crisis × Average Chaebol share in the industry before the crisis	-0.020	0.675	0.127	0.440
	(0.442)	(0.505)	(0.538)	(0.489)
Trend × Average Chaebol share in the industry before the crisis	0.222***	0.410***	-0.033	-0.024
	(0.081)	(0.080)	(0.087)	(0.079)
Trend × Post crisis × Average Chaebol share in the industry before the crisis	-0.351***	-0.662***	0.204	0.197
	(0.131)	(0.140)	(0.147)	(0.138)
# of Observations	1,406	1,067	1,067	1,406
# of Industries	128	97	97	128

Notes: Industries are defined by the ISIC Rev. 4, up to 4-digit. Industry fixed effects and the constant term are included in the regressions. ***, **, and * represent that coefficients are statistically significant at 1%, 5%, and 10 % level, respectively. Standard errors are clustered in each industry level and given in parentheses. Trend = Year – 1998.

Table 12. Firm dynamics: Markups.

All industries				
	Chaebol	Non-Chaebol	Chaebol	Non-Chaebol
Post Crisis	0.335** (0.130)	0.201*** (0.020)	0.643*** (0.218)	0.203*** (0.025)
Post crisis × Average Chaebol share in the industry before the crisis	—	—	-0.927* (0.553)	-0.016 (0.091)
# of Observations	1,292	2,226	1,292	2,226
# of Industries	216	227	216	227
	Industries above the median Chaebol share		**Industries below the median Chaebol share**	
Post Crisis	0.278 (0.187)	0.246*** (0.043)	0.490*** (0.179)	0.207*** (0.028)
# of Observations	665	759	490	757
# of Industries	78	78	77	77

Notes: The regressions were run after excluding top and bottom 1% of each dependent variable for the whole sample period. Industries are defined by the 8th KSIC, up to 5-digit. Industry fixed effects and the constant term are included in the regressions. ***, **, and * represent that coefficients are statistically significant at 1%, 5%, and 10 % level, respectively. Standard errors are clustered in each industry level and given in parentheses. The regressions for all industries use industries that showed non-trivial Chaebol shares during the sample period (1992-2003). The industries above and below the median Chaebol share are based on the median of each industry's Chaebol sales share before the crisis (1992-1997). Markups are calculated using Cobb-Douglas production function and the endogenous productivity process.

Table 13. Firm dynamics: Markups (Surviving firms).

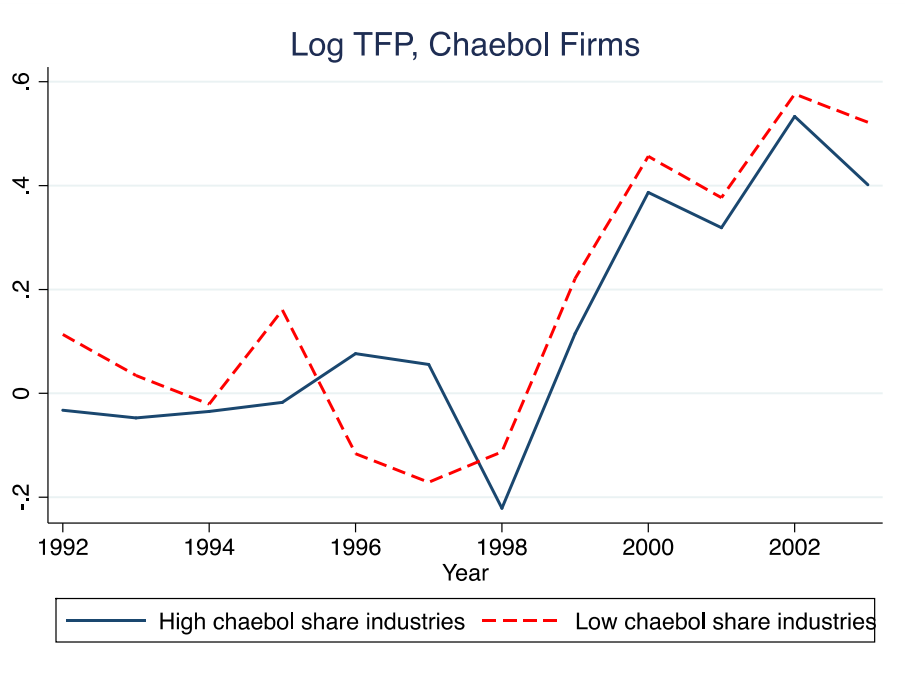
	All industries			
	Chaebol	Non-Chaebol	Chaebol	Non-Chaebol
Post Crisis	0.260** (0.112)	0.180*** (0.021)	0.488*** (0.184)	0.188*** (0.025)
Post crisis × Average Chaebol share in the industry before the crisis	—	—	-0.710* (0.420)	-0.047 (0.096)
# of Observations	1,134	2,215	1,134	2,215
# of Industries	174	226	174	226
	Industries above the median Chaebol share		**Industries below the median Chaebol share**	
Post Crisis	0.242 (0.177)	0.213*** (0.044)	0.395** (0.178)	0.194*** (0.028)
# of Observations	604	748	472	756
# of Industries	71	78	74	77

Notes: The regressions were run after excluding top and bottom 1% of each dependent variable for the whole sample period. Industries are defined by the 8th KSIC, up to 5-digit. Industry fixed effects and the constant term are included in the regressions. ***, **, and * represent that coefficients are statistically significant at 1%, 5%, and 10 % level, respectively. Standard errors are clustered in each industry level and given in parentheses. Surviving firms denote firms that first appeared in the sample during 1992-1997, last appeared during 1999-2003, and appeared for at least 3 years. The regressions for all industries use industries that showed non-trivial Chaebol shares during the sample period (1992-2003). The industries above and below the median Chaebol share are based on the median of each industry's Chaebol sales share before the crisis (1992-1997). Markups are calculated using Cobb-Douglas production function and the endogenous productivity process.

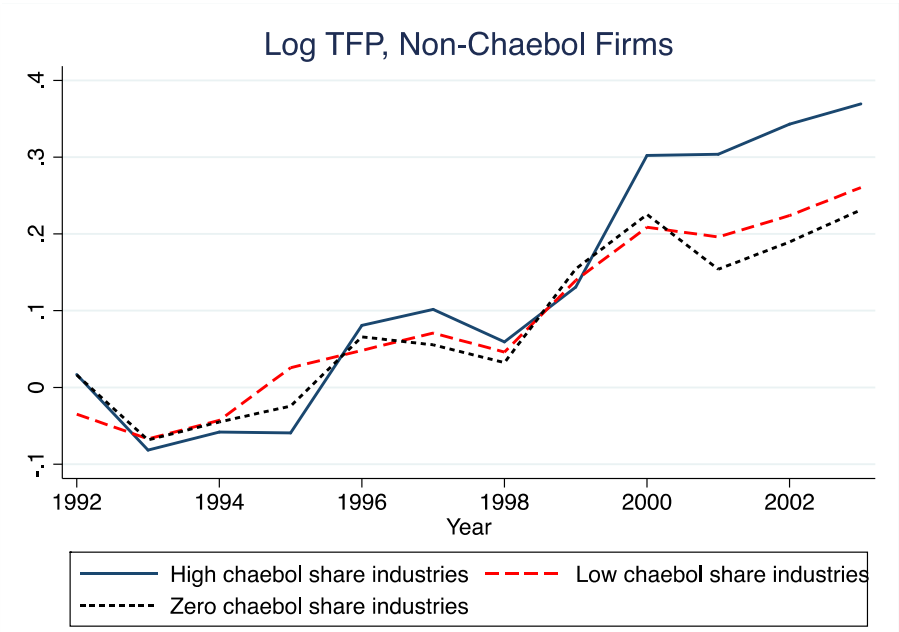
Figures

Figure 1. Logarithm of total factor productivity (TFP) in chaebol and non-chaebol Firms in industries with high, low and zero chaebol share.

Panel A:



Panel B:



Industries are classified by the average 1992-97 chaebol share: high (above median), low (below median), and zero. Industry-level log TFPs are normalized by 1992-97 average = 0. The median average chaebol share in 1992-97 is 0.20.

Figure 2. Patenting activity in chaebol and non-chaebol firms.

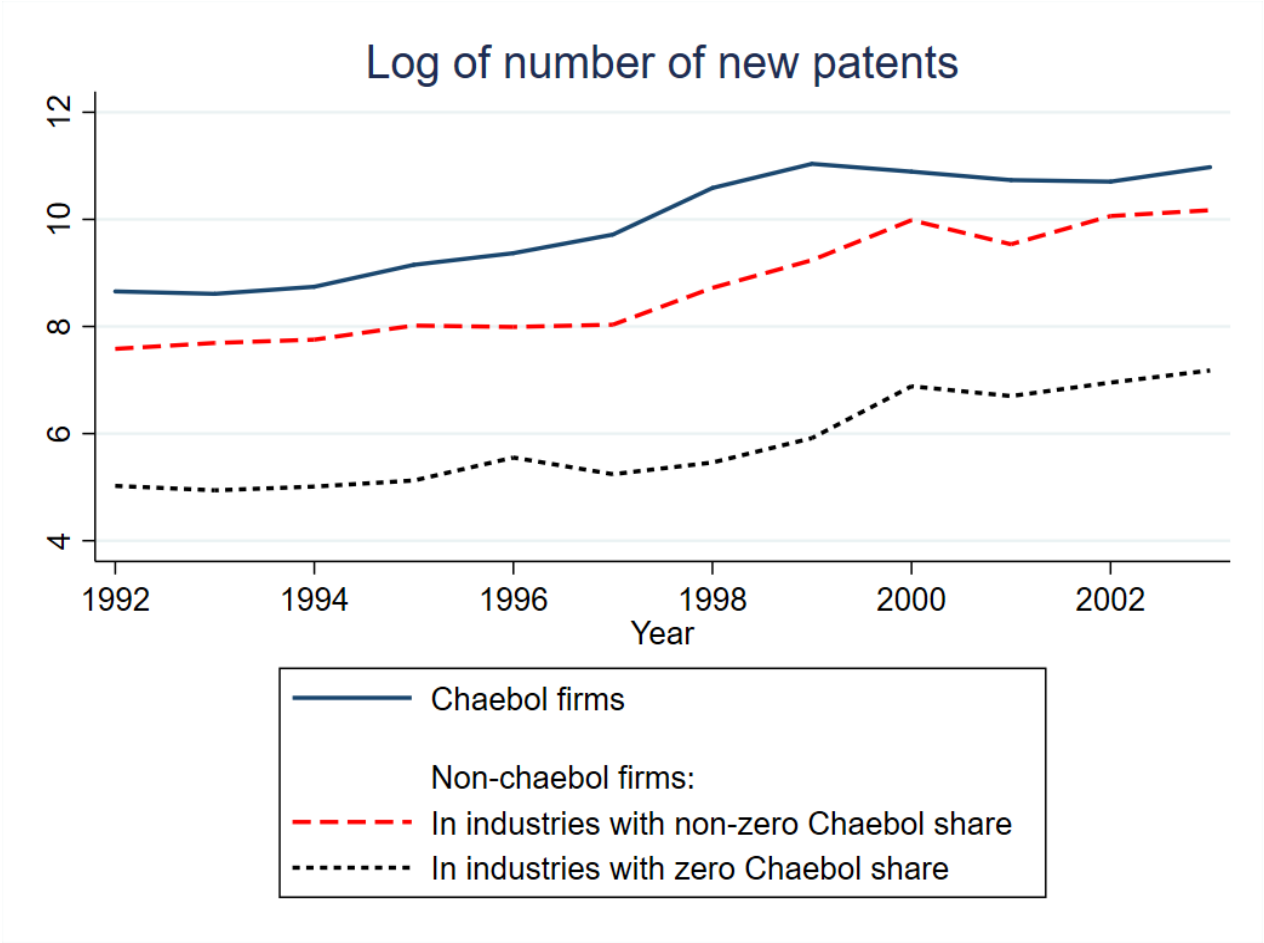
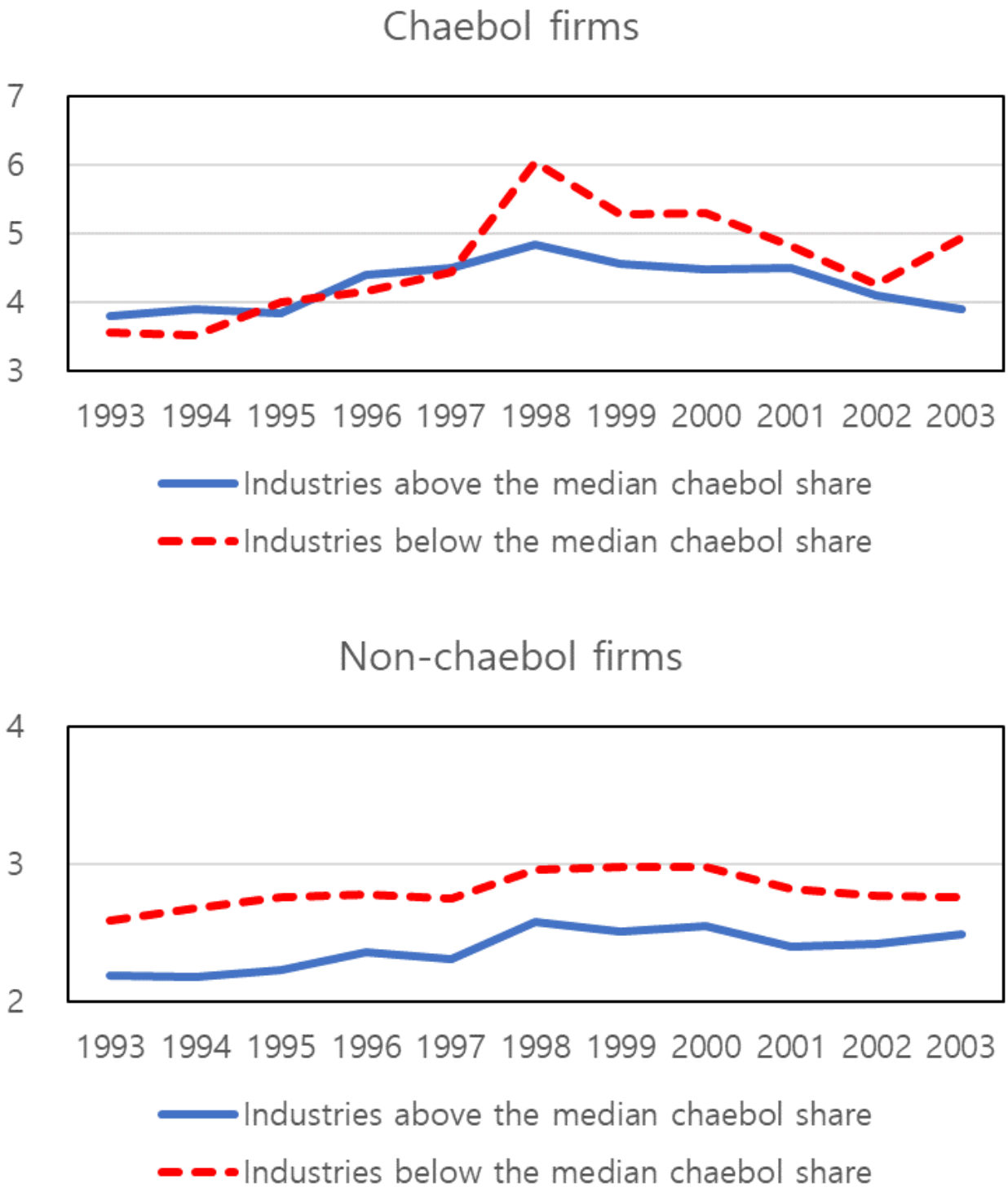


Figure 3. Mean markups of chaebol and non-chaebol firms by industry categories.



Note: The figures are mean of each industry level average markup for chaebol and non-chaebol firms, excluding top and bottom 1% for the whole sample period in each industry categories.